UNIVERSITY OF NOVI SAD | FACULTY OF SCIENCES
DEPARTMENT OF GEOGRAPHY, TOURISM AND HOTEL MANAGEMENT

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Review article

DECARBONIZING TRANSPORT: THE ROLE OF HYDROGEN FUEL CELL ELECTRIC VEHICLES IN REDUCING EMISSIONS

Vasile Popa[A]

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ABSTRACT

Climate change, air pollution and noise, among other environmental problems, are increasingly affecting human society and the natural environment. Among the main sources of greenhouse gases and pollutant emissions in the atmosphere is the transport sector. To decrease the use of fossil fuels in the transportation sector, hydrogen fuel cell electric vehicles (HFCEVs) have been proposed as a potential alternative, among others. Although not completely green, from a life-cycle perspective, HFCEVs can have a lower climate impact than conventional vehicles, depending on how the hydrogen is produced. Widespread use of renewable energy sources can significantly reduce this impact. The research results show an increase in HFCEV sales recently (but far below the level of battery electric vehicles), concerns about the introduction of hydrogen in all transport sectors (road, rail, sea or air), still limited distribution of the infrastructure refuelling, and high production costs. HFCEVs could contribute to the decarbonization of transport and all efforts, including research and development, should be stepped up to support them and identify the best solutions to current challenges.

Keywords: *hydrogen, electric mobility, fuel cells, challenges, effects on the environment*

INTRODUCTION

It is believed that hydrogen can support the transition to mobility, based on renewable sources, offering a solution for the decarbonization of the transport sector, responsible for high emissions of greenhouse gases (Dunn, 2002, Veziroğlu, Şahin, 2008, Dutta, 2014, Fayaz et al., 2012, Larsson et al., 2015, Kim et al., 2020, Fragiacomo, Genovese, 2020, Soleimani et al., 2024). Hydrogen is very abundant in the environment, but it is always found bound to other chemical elements, such as oxygen. Hydrogen can be produced through a wide variety of technologies:

- Electricity-based hydrogen refers to hydrogen produced by the electrolysis of water (the process by which water is broken down into hydrogen and oxygen, which takes place in the electrolyzer, powered by electricity), regardless of the source of electricity.
- Hydrogen from renewable sources is hydrogen produced by the electrolysis of water, with electricity from renewable sources.

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- Fossil fuel hydrogen refers to hydrogen produced by various processes that use fossil fuels as raw material, especially natural gas or coal gasification; this type of hydrogen accounts for most of the hydrogen produced today.
- Fossil fuel hydrogen with carbon capture and storage is a component of fossil fuel hydrogen, but here the greenhouse gases emitted in the hydrogen production process are captured and stored.

Depending on how the hydrogen is produced, several colors have been proposed, such as black, brown, gray, blue, and green (Ravi, Aziz, 2022). Black and brown hydrogen refers to hydrogen produced from coal (black or brown) through gasification technology. Gray and blue hydrogen refer to hydrogen produced from natural gas, without or with carbon capture, and green hydrogen is produced by electrolysis of water, using renewable energy sources.

Currently, about three-quarters of annual hydrogen production is produced from natural gas, followed by coal. Only a small part of the hydrogen comes from the electrolysis of water (IEA, 2019). Hydrogen is predominantly used in industry: oil refining, ammonia production, methanol production or steel production. The use of hydrogen in transport is still very limited, although hydrogen is a promising option, especially in trains, local buses, trucks, coaches, special purpose vehicles, and boats used mainly in inland waterway transport (EC, 2020).

In the transport sector, most of the hydrogen is used in road transport, but it is also increasingly used in rail transport. Such trains are being tested and adopted in several places. In 2022, hydrogen consumption in road transport represented about 32 thousand tons, up 45% compared to 2021 (in 2020, consumption was about 15 thousand tons), because of increased sales of HFCEVs (IEA, 2023a).

Like fully electric vehicles, HFCEVs use electricity to power an electric motor. But unlike other electric vehicles, which are powered by a large and heavy battery (mostly a lithium-ion battery), HFCEVs produce electricity using a fuel cell stack, which can contain hundreds of fuel cells. A fuel cell is a device that generates electricity through an electrochemical reaction (Figure 1). Hydrogen and oxygen are combined to generate electricity, heat, and water. Each fuel cell is composed of two electrodes (a negative anode and a positive cathode), an electrolyte and a catalyst to speed up the reactions. A typical fuel cell works by passing hydrogen through the anode of a fuel cell and oxygen through the cathode. At the anode, a catalyst splits hydrogen molecules into electrons and protons. Protons pass through a porous electrolytic membrane to the cathode, while electrons are forced through a circuit, generating an electric current and excess heat. After passing

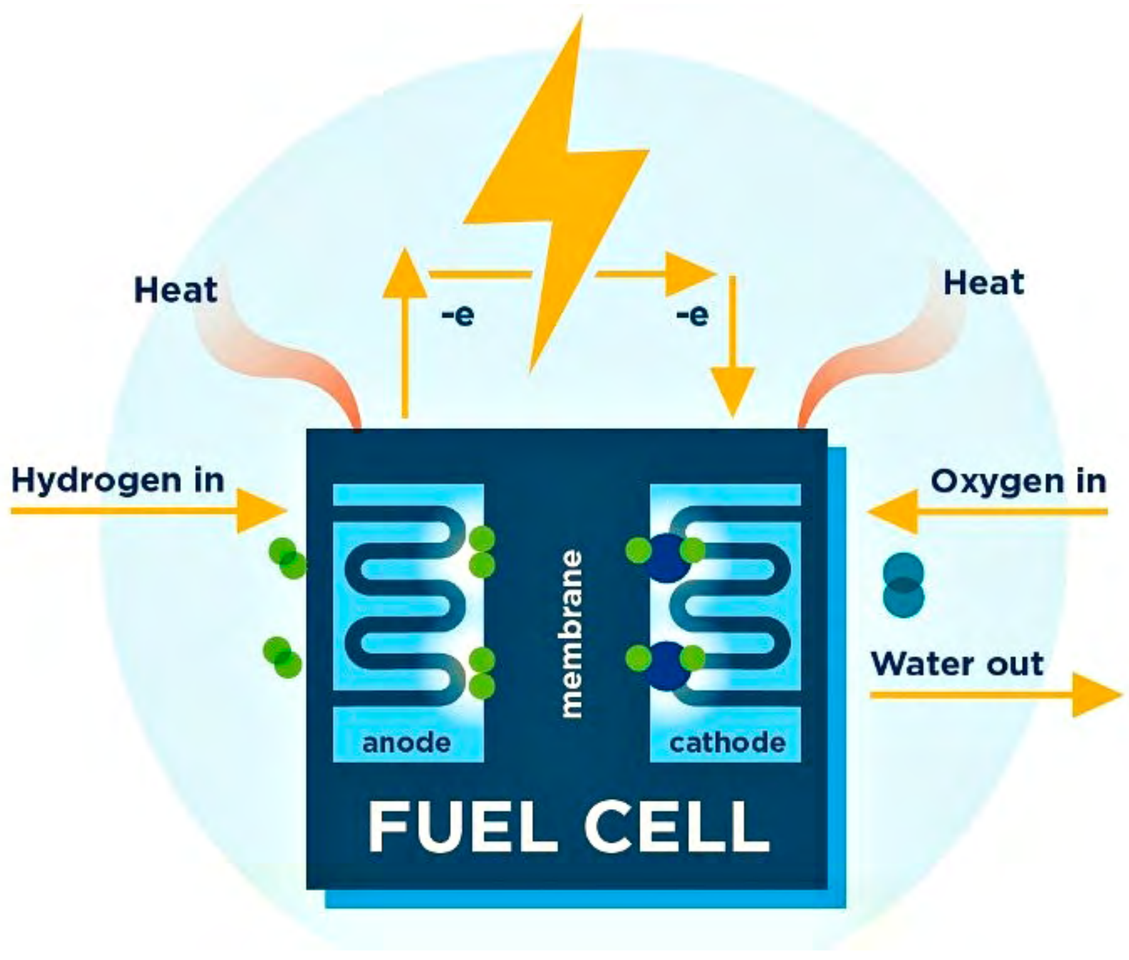

Figure 1. Operation of a hydrogen fuel cell
(Source: FCHEA, 2024)

through the circuit, at the cathode, the electrons combine with the protons and oxygen to produce water molecules (FCHEA, 2024). The electricity produced by the fuel cells powers an electric motor or is stored in a battery, which also takes the energy captured every time the vehicle brakes.

The first fuel cell, which produced electricity by combining hydrogen and oxygen, was invented by Welshman W. R. Grove in 1839. Although Grove discovered the principle of fuel cells, the first experiments were made by British engineer Francis Thomas Bacon in the early 1940s (The Chemical Engineer, 2012). Their first practical application was for the United States' Apollo space vehicles.

Hydrogen fuel cells are an environmentally friendly energy source, with the only byproducts being heat and water. However, fuel cell degradation is one of the key technological challenges reported (Wang et al., 2018, Zhao, Lee, 2019, Ren et al., 2020), which can affect vehicle performance over time.

HFCEVs have certain advantages over other technologies (Table 1): they significantly reduce greenhouse gas emissions compared to gasoline vehicles (depending on how hydrogen is produced); removes only water and heat in operation; they have high-energy efficiency; autonomy and refueling are comparable to classic vehicles; it operates silently and requires minimal maintenance (Halder et al., 2024). Finally, hydrogen is an abundant and renewable energy source, ideal in policies to decarbonize the economy.

Table 1. Comparison of different vehicle propulsion systems

Vehicle technology	Advantages	Disadvantages
Diesel engine vehicles	· Mature technology · Convenient refueling · High durability · Convenient prices	· High emissions of greenhouse gases and other pollutants · Noise pollution · Volatile fuel prices · Low-energy efficiency
Battery electric vehicles	· Relatively mature technology · No exhaust emission · Quiet engine, no noise	· Quite long recharge time · Relatively short battery lifetime · Relatively limited driving range · The supply of critical minerals needed for batteries
Hydrogen fuel cell electric vehicles	· No exhaust emission · Convenient refueling · Flexible driving range · High-energy density	· High technological costs · High cost of green hydrogen · Limited hydrogen infrastructure

In addition to HFCEVs, hybrid models have also been proposed that benefit from auxiliary energy sources (batteries, super capacitors). It is believed that these additional energy sources could reduce fuel cell degradation, increase fuel economy and provide energy during cold start (Das et al., 2017, Depature et al., 2020). But larger batteries are needed, especially plug-in batteries. Hydrogen can also be used in internal combustion engines as the main fuel or as an additional fuel by blending with other fuels (Gurz et al., 2017, Villar et al., 2020).

This study looks at the current situation of hydrogen-based mobility and the challenges it faces, including meeting hydrogen needs and its production cost, refueling infrastructure or environmental impact.

MATERIALS AND METHODS

This paper uses various quantitative and qualitative methods to collect, interpret and update data on hydrogen-based mobility and the challenges of its future evolution. The quantitative data used in this work were taken from international sources and databases (International Energy Agency, Hydrogen Council, Statista, Fuel Cell & Hydrogen Energy Association or H2stations.org), but also from consulting specialized articles

and other sources. To highlight the evolution of some indicators, such as the global stock of hydrogen-based fuel cell electric vehicles, graphical methods were used which were subsequently interpreted.

Scenarios and estimates for the future development of hydrogen-based projects were based on data published by the International Energy Agency and estimates by the Hydrogen Council-McKinsey & Company. The identification of hydrogen's role in the global effort to combat climate change, technological challenges and its negative environmental effects during its life cycle was based on several scientific articles published in specialized journals as well as other sources such as Hydrogen Insight. Overall, the examination of the current state of hydrogen-based mobility and development challenges was based on specific analytical research.

RESULTS

Hydrogen-based mobility in road transport

Asian companies are the most advanced in the field of hydrogen-based road transport. One of the first research works on this type of energy was carried out by the Honda company. It began applying fuel cells to passenger vehicles in the second half of the 1990s, and in 2002 launched the FCX model simultaneously in Japan and the US. In 2008, Honda launched the FCX Clarity, the world's first HFCEV dedicated to mass production, followed by the Clarity Fuel Cell in 2016. The newest model, the 2024 CR-Ve:FCEV, is North America's first plug-in fuel cell electric vehicle, combining plug-in charging capability with fast hydrogen refueling (Honda Motor, 2024). HFCEV research and development programs have also been carried out by the Japanese company Toyota since 1992. It was only in December 2014 that Toyota was able to launch the first HFCEV, called Mirai (Toyota Motor Corporation, 2018). By 2022, around 22,000 such vehicles have been sold, mostly in the US and Japan, with 3,900 units sold in 2022 alone (Carbon Credits, 2023).

Another Asian company with early concerns in hydrogen mobility is Hyundai Motor. Following the Mercury project, from 1999, carried out in collaboration with United Technologies Corporation, the MercuryII vehicle resulted (Hyundai Motor Company, 2020). After the presentation of the ix35 Fuel Cell prototype (in 2010), sold in several countries around the world, in 2018 Hyundai launched the NEXO model, which became the best-selling HFCEV in the world in 2022, with 10,527 units (Hydrogen Insight, 2024a).

The first car manufacturer in China to develop HFCEV technology is SAIC Motor, which in 2001 launched the Phoenix No1 project. Following the 2016 Roewe 950, which was the first fuel cell sedan licensed and sold in China, in June 2020 the company produced the Maxus EUNIQ 7, the world's first fuel cell MPV (multipurpose vehicle). Recently, SAIC Motor has introduced various types of HFCEVs (multipurpose vehicles, light buses, coaches, light trucks or heavy trucks), operating in several cities in China (SAIC Motor, 2020).

In Europe, the BMW company relies on fuel cell technology and has been working on this technology since 2000. In their commitment to achieve net-zero emissions by 2050, the German company started developing its own hydrogen fuel cells and launched in February 2023 the BMW iX5 Hydrogen model. The objective of the German manufacturer is to bring this pilot vehicle to market by 2030 (BMW Group, 2023). Another German manufacturer, Mercedes-Benz, has designed the GLC F-CELL, a unique plug-in hybrid that combines innovative fuel cell and battery technologies for the first time; apart from electricity, the vehicle also runs on pure hydrogen (Mercedes-Benz Group, 2024).

In the United States, the General Motors company presented the Chevrolet Colorado ZH2 model, designed for more rugged terrain conditions, and NamX, a Moroccan startup, produced in 2022 a prototype SUV that benefits from a double hydrogen tank (a fixed tank and a detachable tank consisting of six replaceable hydrogen capsules), expected to be launched in 2026 (NamX, 2024).

Like passenger cars, the number of hydrogen fuel cell buses has also increased. The first concerns regarding the development of such vehicles were in the USA in the late 1980s and early 1990s. The most notable pro-

ject was the Georgetown Fuel Cell Bus, which resulted in the first fuel cell (phosphoric acid-based) bus. Since the late 1990s, hydrogen fuel cell buses have been tested and experimented with in several places (Eudy et al., 1997). In 2001, the Toyota Company completed the FCHV-BUS1, a city bus powered by a hydrogen fuel cell hybrid system jointly developed with Hino Motors (Toyota Motor Corp., 2001). This bus was tested in Tokyo in 2003 and then a fleet of eight such buses was used at Expo 2005 in Aichi (Japan). Subsequently, various other companies produced hydrogen fuel cell buses, such as Foton, Yutong, Higer, Zhongtong, Sunwin (all from China), Hyundai (South Korea), Wrightbus (UK), Van Hool (Belgium), New Flyer (Canada), Mercedes-Benz (Germany) or Solaris (Poland).

To promote hydrogen-based buses, numerous programs have been funded in Europe, such as CUTE, CHIC, or JIVE. CUTE (Clean Urban Transport for Europe) was the first large-scale project to test 27 fuel cell buses in nine European cities (Hamburg, London, Barcelona, Stockholm, Porto, Stuttgart, Amsterdam, Luxembourg, and Madrid), during 2001-2006. It was followed by the CHIC (Clean Hydrogen in European Cities) project, carried out between 2010 and 2016, and the JIVE (Joint Initiative for Hydrogen Vehicles across Europe) projects, carried out between 2017 and 2020 (Fuel Cell Electric Buses, 2024). These projects demonstrated that mobility based on hydrogen can represent a solution for decarbonizing public transport and improving air quality in cities.

The success of these programs is exemplified by the case of the German transport company Regionalverkehr Köln GmbH (RVK), which has the largest fleet of fuel-cell buses. In 2011, RVK took possession of its first fuel cell buses, two Phileas 18 buses from the Dutch manufacturer APTS. Three years later, in 2014, two more New A 330 FC buses were purchased from Van Hool, and in 2020 another 35 buses of this type were ordered. In September 2024, RVK also introduced the first eight Solaris Urbino 18 hydrogen articulated buses, in addition to the 46 Solaris Urbino 12 fuel cell buses already in operation. In the future, 20 more Solaris hydrogen buses will be added: nine 12m buses and eleven 18m buses. By the end of 2025, RVK aimed to have almost half of its buses be hydrogen-based, i.e., 160 units (Marquordt, 2024, Solaris Bus & Coach, 2024).

Northern Irish company Wrightbus has built the world's first double-decker fuel cell bus, called the Hydroliner, which was officially launched in 2021 in Aberdeen. It now has fleets operating in five cities in the UK and Ireland (Aberdeen, Birmingham, London, Belfast and Dublin), which have cumulatively covered more than 1.5 million km (The Advanced Propulsion Center UK, 2024). Worldwide, as of June 2023, there were approximately 7,000 fuel cell buses, most (around 85%) in China. The second position was occupied by Europe, then South Korea, the United States and Japan (IEA, 2023a).

Hydrogen fuel cell trucks are also gaining popularity as an alternative to traditional diesel trucks. The stock of fuel cell trucks grew faster than that of light vehicles, growing by more than 60% in 2022, with a total of more than 8,000 units by mid-2023. In 2022, most sales took place in China, which now accounts for over 95% of the market, thanks to favorable policy and supporting infrastructure. Such trucks are also used in other countries. For example, Hyundai Xcient trucks have accumulated around 5 million km in Switzerland as of 2020, but also operate in Germany, South Korea and New Zealand. The partnership between Hyundai Motor and H2Energy aims to introduce 1600 Hyundai H2 Xcient Fuel Cell trucks in Europe (Hyundai Motor Company, 2020).

According to CALSTART's Zero-Emission Technology Inventory (ZETI), approximately 20 fuel cell medium- and heavy-duty truck models were available in 2022, with several additional models planned for 2023 (IEA, 2023). According to Blackridge Research & Consulting (2024), the main companies producing fuel cell trucks are: Beiqi Foton Motor, Dayun, Dongfeng Motor, FAW Group, Great Wall Motor, Hyundai Motor, Hyzon Motors, Nikola Corporation, SAIC Iveco Hongyan and SINOTRUK (China National Heavy-Duty Truck Group). Except Hyundai Motor, Nikola Corporation and Hyzon Motors (the last two are American), the rest are Chinese.

More and more HFCEVs have hit the world's roads lately (Figure 2). If in 2017 there were around 7,200 units, in the middle of 2023 it reached 80,000 units, of which 63,000 were light vehicles (IEA, 2023a). If in 2017 all HFCEVs were cars, today more than 20% of them are buses and trucks. This shows a shift to vehicles where hydrogen can be more competitive.

There are notable differences in the geographic distribution of different types of HFCEVs (Figure 3). South Korea is the largest market, with a stock of more than 32,000 such vehicles in the first half of 2023. About

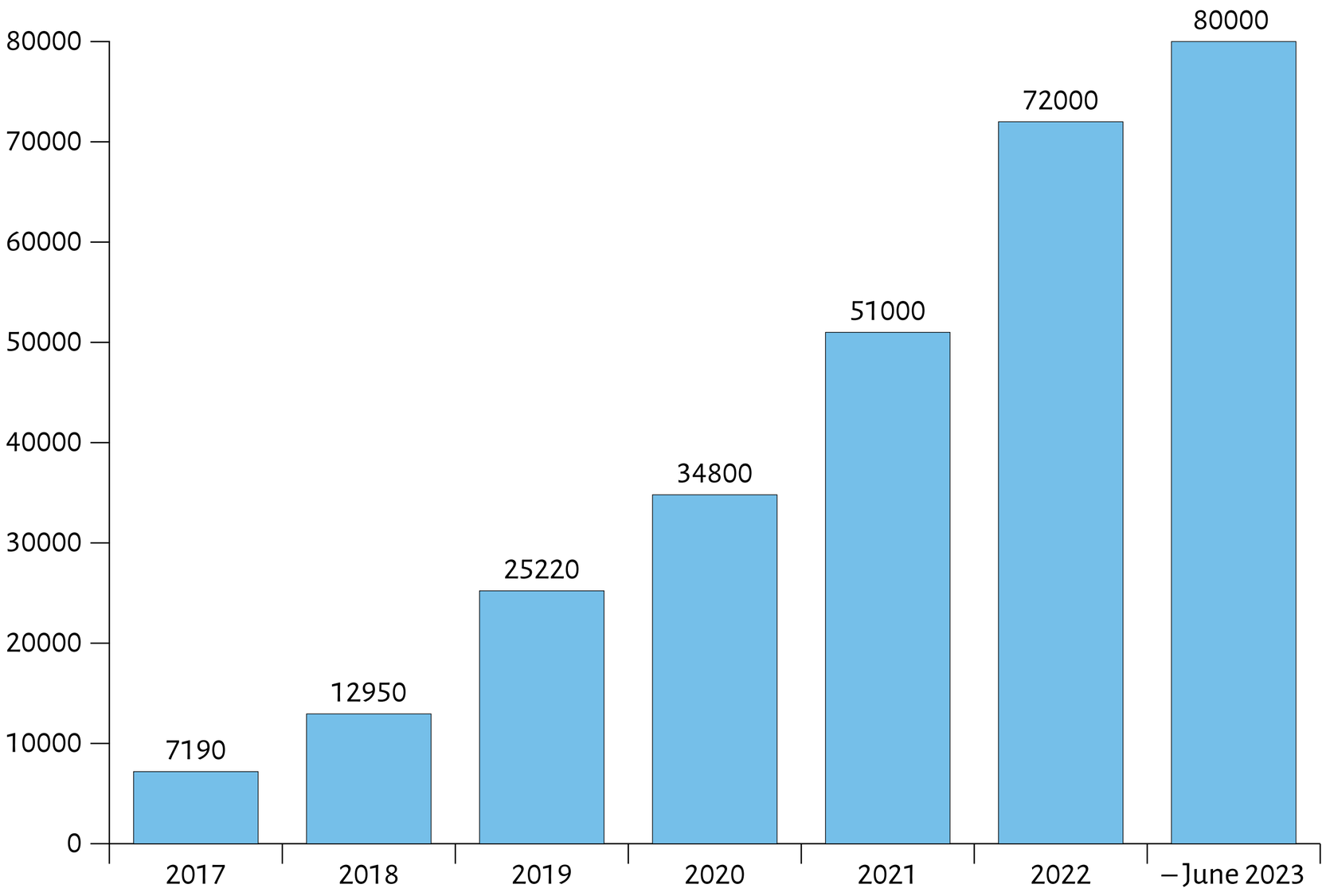

Figure 2. Fuel cell electric vehicle stock (2017-2023)

(Source: IEA, 2019b, IEA, 2023a)

15,000 HFCEVs were sold in 2022 and less than 3,000 in the first half of 2023 (some slowdown compared to the nearly 4,900 at the same time frame the previous year). As South Korea, the United States and Japan have focused their efforts on the implementation of light passenger cars, they hold 90% of the stock of this segment but have a few buses and commercial vehicles. On the other hand, China has the largest stocks of fuel cell buses and commercial vehicles (IEA, 2023a). In the United States, most HFCEVs are in California, while in Europe, Germany is in first place.

It is believed that as technology costs decrease, energy optimization improves, range increases, and fueling stations multiply, the demand for HFCEVs will increase (Tanç et al., 2019). According to the Hydrogen Council and other estimates, as the market grows and costs fall, HFCEVs could exceed 13 million units by 2030,

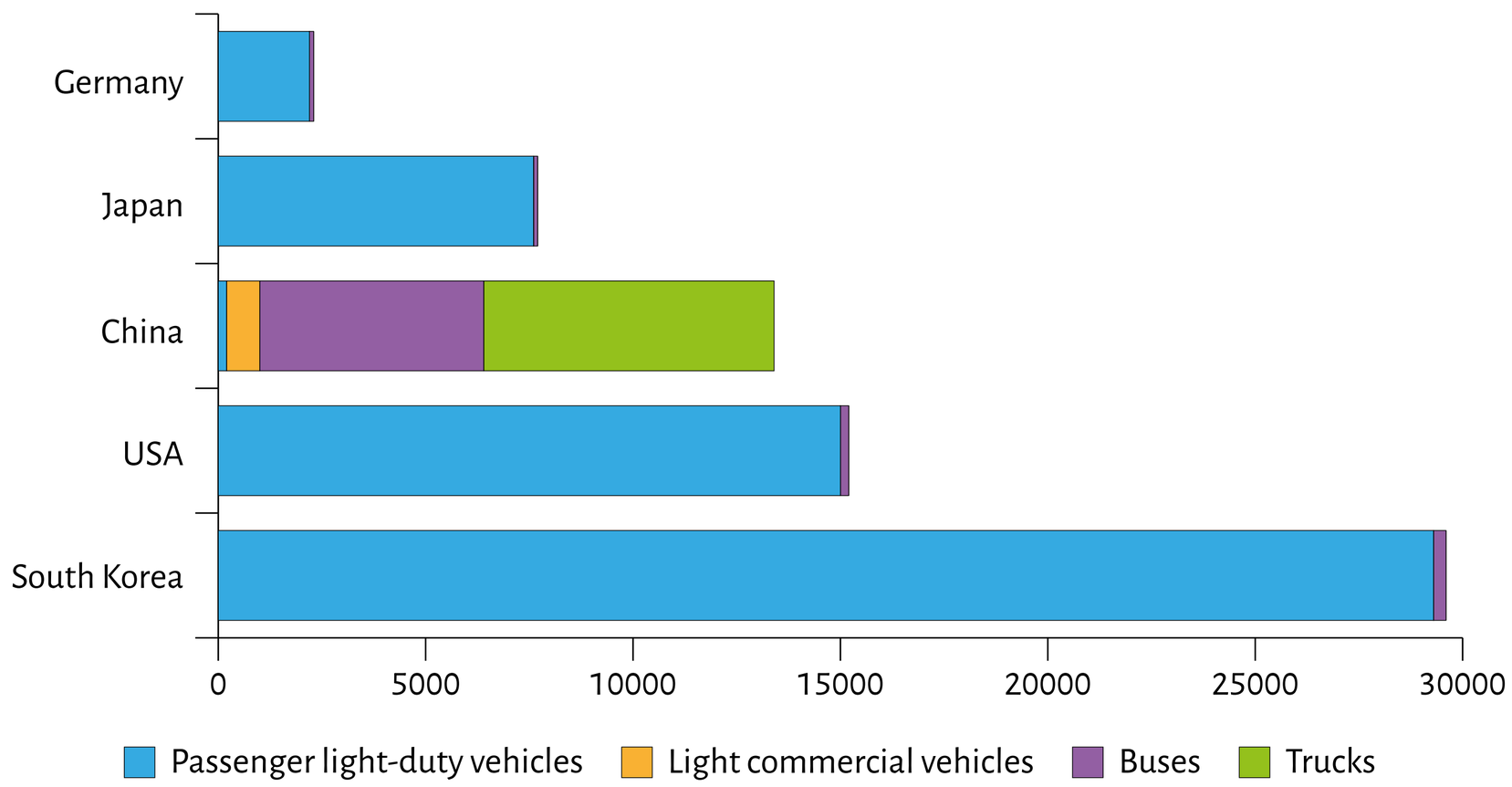

Figure 3. Global fuel cell electric vehicle fleet in selected countries as of 2022, by vehicle segment

(Source: Statista, 2023)

and commercial vehicles, including trucks, light commercial vehicles and buses, could exceed 1 million units (S&P Global, 2020, Hadler et al., 2024) (Table 2). For example, according to the Fuel Cell Vision 2030 strategy, Hyundai Motor Group aimed to increase the annual production capacity of HFCEVs to 700,000 units by 2030 (Hyundai Hotor Company, 2020). However, current growth rates are too low for these targets to be achieved.

Table 2. Hydrogen deployments 2020 vs. 2030 outlook

	Global		Europe		North America		Asia	
	2020	2030	2020	2030	2020	2030	2020	2030
Electrolysis (MW)	134	NA	84	>10,000	9	NA	30	NA
Hydrogen Refueling Station (operational)	407	>10,000	170	3,700	66	4,300	163	2,560
FCEVs	16,000	13 million	1,300	4.2 million	7,800	3.7 million	6,300	5.1 million
Commercial Vehicles	1,600	1 million	91	45,000	32	300,000	1,500	650,000

Source: Hydrogen Council, cited by S&P Global, 2020

Hydrogen-based mobility in rail transport

In the railway sector, hydrogen is used to replace diesel. Alstom is the first railway company to invest in hydrogen fuel cell trains as an alternative to diesel for non-electrified lines. At InnoTrans 2016 in Berlin, Alstom presented the world's first passenger train powered by fuel cells, called the Coradia iLint. The first two trains of this type entered commercial service in September 2018 in Lower Saxony (Germany) and to date 41 trains have been ordered by two German Länder and tests have taken place in the Netherlands, Austria, Sweden, France, Poland, or Canada. The Coradia iLint achieves a top speed of 140 km/h, acceleration and braking performance comparable to a standard regional diesel train, but without the noise and emissions. On September 15, 2022, a Coradia iLint train traveled the record distance of 1175 kilometers without refueling (Alstom, 2024).

Alstom has signed contracts to supply hydrogen trains to Italy's Lombardy and Puglia regions to replace current diesel trains. The Ferrovie Nord Milano company in Lombardy signed a framework agreement in 2020 for the purchase of up to 14 Coradia Stream trains, of which 8 have already been ordered. In March 2021, four French regions (Auvergne-Rhône-Alpes, Bourgogne-Franche-Comté, Grand Est and Occitanie) ordered 12 Régiolis H2 trains powered by electricity and hydrogen. After testing, planned for 2024, they are due to enter commercial service in 2025 (SNCF Groupe, 2024).

As part of the H2goes Rail project (presented to the public in November 2020), carried out together with Deutsche Bahn and financed with 13.7 million euros, as part of the National Innovation Program for Hydrogen and Fuel Cell Technology, Siemens Mobility developed the Mireo Plus H hydrogen train. This train is presented as an alternative to diesel trains for long-distance operation. It has a range of approximately 1000 km and can reach speeds of up to 160 km/h. In September 2022, the first journey with this train took place at a test center in North Rhine-Westphalia. In 2022, Siemens received the first order of 7 Mireo Plus H trains from Niederbarnimer Eisenbahn for the Heidekrautbahn network in the Berlin-Brandenburg metropolitan region, with the trains planned to enter commercial operation from December 2024 (Siemens Mobility, 2024).

The first hydrogen train in the United States was tested in March 2024 in the state of Colorado. It is the Flirt H2 train, made by the Swiss manufacturer Stadler. During the test, the train traveled 2803 km. It is intended for the San Bernadino County Transportation Authority in California. Another four trains were ordered for the California State Transportation Agency (Hydrogen Insight, 2024b).

In Japan, East Japan Railway aims to commercialize the first hydrogen hybrid train, called Hybari (jointly developed with Toyota Motor and Hitachi), in 2030. A trial run of this train was shown to the media on the JR Tsurumi Line in Kanagawa Prefecture on February 28, 2024 (Nikkei, 2024, The Asahi Shimbun, 2024). In China, manufacturer CRRC has completed tests of the country's first passenger train running on hydrogen fuel cells. The train is designed to operate between non-electrified urban railway sections of up to 1000 km with a maximum speed of 160 km/h (Hydrogen Insight, 2024c).

Hydrogen-based mobility in sea and air transport

The Global Maritime Forum has identified many pilot and demonstration projects for the introduction of zero-emission technologies in maritime transport, including hydrogen-based ones. In July 2023, the European Union adopted the Maritime FuelEU regulation, to stimulate the more consistent use of low-carbon fuels in shipping (IEA, 2023a). In March 2023, the world's first hydrogen ferry, the MF Hydra, began operating in Norway. The commissioning of this ferry makes another substantial leap towards the goal of zero emissions for ferries, as well as the maritime industry in general. After tests carried out at the quay in Hjelmeland, Norled received final approvals from the Norwegian Maritime Authority. MF Hydra confirms Norway's world-leading position in the development of new green maritime solutions (Norled, 2024).

Also in March 2023, a gaseous hydrogen ferry was tested in San Francisco. Thus, the Sea Change ferry, owned by Switch Maritime, became the first commercial marine vessel in the United States powered by hydrogen fuel cells (Power Technology, 2023). In February 2024, India's first fuel cell ferry was launched at Cochin Shipyard. The adoption of green hydrogen as a marine fuel is an example of India's commitment to a sustainable future, aiming for net zero emissions by 2070 (Business Standard, 2024).

There are concerns about introducing greener fuels in aviation as well, including hydrogen-based fuels. Boeing has conducted six demonstration projects and has extensive experience using hydrogen as a fuel for launch vehicles and space applications. For example, in 2008, a two-seater Dimona made three flights in Spain, becoming the first manned aircraft in history to use power generated exclusively by hydrogen fuel cells (Boeing, 2024).

ZeroAvia took a step forward. On January 19, 2023, it made its first flight, at Cotswold Airport in Gloucestershire (England), using a prototype ZA600 electric hydrogen engine to power the left-hand propeller of a 19-seat Dornier 228. It was the largest hydrogen-electric powered aircraft at the time. ZeroAvia plans to power zero-emission commercial aircraft by 2025 (ZeroAvia, 2024).

Universal Hydrogen, a company founded in 2020, successfully completed the first flight powered by hydrogen fuel cells in March 2023. The company used a 40-passenger aircraft called the Lightning McClean, which took off from Grant County International Airport (USA) and flew for 15 minutes. The flight was the first in a series of flight tests over a two-year period, which will culminate in 2025 with the entry into commercial passenger service of ATR 72 regional aircraft converted to run on hydrogen. The company has orders from customers all over the world (Universal Hydrogen, 2023).

In 2020, Airbus launched an ambitious plan to bring the world's first up to 200-passenger hydrogen-powered commercial aircraft to market by 2035. To get there, the ZEROe project is exploring a variety of configurations and technologies revolving around establishing means of propulsion, either through hydrogen-electric hybrid fuel cells, or through the direct combustion of hydrogen. In this regard, the company has established dedicated development centers in France, Great Britain, Germany, and Spain. For testing, these technologies will be used by the Airbus A380 MSN1 aircraft (Airbus, 2024).

Several models of unmanned aerial vehicles or drones currently use fuel cells for power. They provide drones with longer flight times and quicker refueling compared to traditional battery-powered drones (FCHEA, 2024).

DISCUSSIONS

Hydrogen production

The expansion of hydrogen-based mobility, without considering other applications, implies an increasing need for hydrogen. Despite being the most abundant element in the Universe (Jain, 2009, Gurz et al., 2017), hydrogen does not exist as such, so it must be extracted from water by electrolysis or separated from fossil fuels. Both processes require a significant amount of energy to carry out, and the energy is not always renewable and can be expensive. Today, hydrogen is mostly obtained from natural gas and coal, and the production process removes carbon dioxide.

In 2022, global hydrogen production was 95 million tons (up 3% from 2021), being almost entirely used for industrial applications and produced almost exclusively from fossil fuels. More than 70% of global production was in China, the United States, the Middle East, India, and Russia. China is the largest consumer of hydrogen, with about 30% of the total, almost double that of the second consumer, the USA. For mobility, the annual hydrogen demand was very low, only 0.02% of the total. However, hydrogen demand has more than tripled since 1975. Low-emission hydrogen production in 2022 was less than 1 million tonnes (0.7% of global production), almost entirely from fossil fuels with capture and carbon storage. Hydrogen production from water electrolysis was very low, below 100 thousand tons, an increase of 35% compared to the previous year (IEA, 2023a). In 2023, according to the Hydrogen Council-McKinsei & Company, the production of hydrogen from renewable sources was about 150 thousand tons, which represented about 15% of the global production of clean hydrogen, which is 860 thousand tons.

Regarding hydrogen obtained by electrolysis of water with electricity produced from renewable sources, the electrolysis capacity reached 1.1 GW in 2023, increasing by about 60% compared to 2022 (700 MW). Much of this growth was driven by a single 260 MW project in China. Moreover, the largest installed electrolysis capacity is in China (610 MW), followed by the United States and Germany (60 MW each), then Spain, Taiwan, Sweden and Canada (each with approximately 25 MW). In China, 90% of electrolysis capacity is based on alkaline technology, while proton exchange membrane technology is more widespread in Europe and North America, accounting for 80% of total installed capacity (Hydrogen Council-McKinsei&Company, 2023).

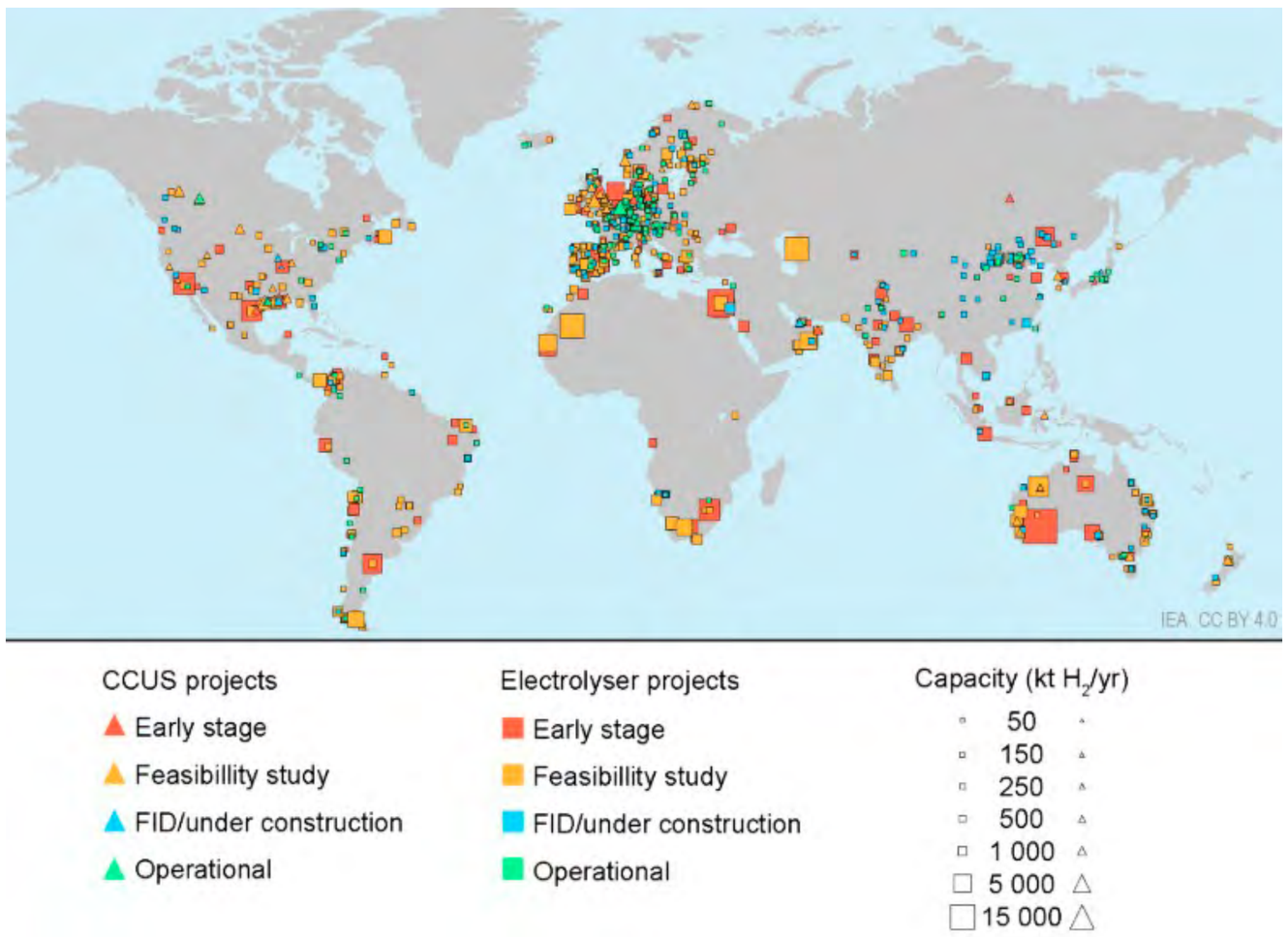

Figure 4. Map of announced low-emission hydrogen production projects

(Source: IEA, 2023a; IEA Hydrogen Projects, October 2023 release)

In addition to the 860 thousand tons/year of operational capacity today, about 2.2 million tons/year of clean hydrogen passed the final investment decision. The largest committed and operational capacity is low-carbon hydrogen (1.7 million tons/year), and the rest is hydrogen from renewable sources. North America (particularly the US) represents the largest market in terms of committed clean hydrogen capacity, with volumes of approximately 1.8 million tonnes/year. About 90% of these volumes are low-carbon hydrogen (Hydrogen Council, McKinsei&Company, 2023).

Although low-emission hydrogen still accounts for less than 1% of global hydrogen production and use, it could reach 20 million tons in 2030 if all announced projects are completed (Figure 4). However, projects that are currently under construction or have taken a final investment decision represent only 4% of production. The rest comes from projects that are undergoing feasibility studies (50%) or in very early stages. Electrolysis projects dominate among announced projects: over 70% of low-emission hydrogen production in 2030 could come from electrolysis, with most announced projects in Europe (mostly Spain, Denmark, Germany, Netherlands) and Australia. However, 55% of announced electrolysis projects are in the early stages of development (IEA, 2023a).

The cost of hydrogen production

Although the production cost of hydrogen may decrease as technology advances, it is currently a barrier to the widespread use of hydrogen. The production cost of hydrogen depends on the technology and cost of energy used, which usually show significant regional differences. The cost of hydrogen produced by electrolysis is also determined by the cost of the electrolyzer.

Currently, neither green hydrogen nor fossil fuel hydrogen with carbon capture is competitive with fossil fuel hydrogen. The estimated cost for hydrogen based on fossil fuels, especially natural gas, is around €1.5 per kg, being highly dependent on the price of natural gas. The estimated cost for fossil fuel-based hydrogen with carbon capture and storage is around €2 per kg, and the cost for green hydrogen at €2.5-5.5 per kg (EC, 2020). More recent data shows a green hydrogen cost of €3-8 per kg (PwC, 2022).

It is believed that as the production cost of renewable energy and the electrolyzer will decrease, green hydrogen will become more competitive, making it a viable source for various applications, including transportation. It is estimated that the cost of green hydrogen could drop by 30% by 2030 because of the falling cost of renewable energy and the increase in hydrogen production. Fuel cells, refueling equipment and electrolyzers can all benefit from mass production (IEA, 2019). The cost of automotive fuel cells has fallen by 70% since 2008 due to technological progress and increasing sales of HFCEVs (IEA, 2021a).

According to PwC (2022) estimates, the production cost of hydrogen will fall by about 50% by 2030 and then continue to fall steadily but more slowly until 2050. The production cost of green hydrogen in parts of the Middle East, Africa, Russia, China, USA, and Australia will be in the €1 per kg range by 2050, and in regions with limited renewable resources such as parts of Europe, Japan, and South Korea it will exceed €2 per kg, making these markets likely to import green hydrogen from elsewhere.

Already the cost of electrolytic hydrogen has fallen by 60% over the past ten years and is expected to halve by 2030 compared to the current situation. In regions where electricity from renewable sources is cheap, green hydrogen is expected to be able to compete with fossil fuel hydrogen by 2030 (EC, 2020). What is certain is that the cost of renewable electricity has already fallen significantly over the past decade, with an 80% reduction in the cost of solar modules between 2010 and 2020 (IEA, 2023a).

On the other hand, recently, the cost of electrolyzers has increased due to rising material and labor costs, ranging from $1700/kW to $2000/kW. Alkaline electrolyzers made in China are much cheaper than those made in Europe or North America, i.e., 750-1300 USD/kW. Inflation and rising labor costs have had a considerable impact on projects being developed. For example, the cost of Saudi Arabia's NEOM Green Hydrogen project has increased from $5 billion to $8.5 billion due to inflation, rising supply chain costs, and expanding the scope of the project to include lines of transport and other infrastructure equipment (IEA, 2023a).

Fuel cell vehicles versus battery electric vehicles

Both types of vehicles have zero tailpipe emissions. Unlike battery electric vehicles, fuel cell ones can be charged faster (within minutes), have a longer range, a longer operating time and are less affected by temperature, but are less efficient from an economic perspective (Lee et al., 2018, Halder et al., 2024).

If in the early 2000s, these two types of vehicles competed in the race to decarbonize the automotive industry, today battery electric vehicles are way ahead. Well over 10 million electric light-duty vehicles (including plug-in hybrid electric vehicles) were sold in 2022, i.e., 14% of all new cars sold in 2022. Regarding the stock of battery electric vehicles, in 2022 it exceeded 26 million (of which 30% plug-in hybrid electric vehicles) (IEA, 2023b).

Major car companies have been quick to electrify their lineups, while only a few hydrogen car models are available. In 2024, the top two hydrogen cars, the Toyota Mirai and the Hyundai Nexo, were priced above $50,000 and above $60,000, respectively (Table 3). On the other hand, a growing number of battery electric vehicles cost less, thanks to the falling price of lithium-ion batteries (MIT, 2023). In addition, electric vehicles have another crucial advantage: there is already a vast electric system.

Table 3. Some key features of Toyota Mirai and Hyundai NEXO

Vehicle model	Driving range (km)	Hydrogen tank capacity (kg)	Power of Fuel Cell System (kW)	Number of cells	Starting price (US$)
Toyota Mirai	575-647	5,6	128	330	50,190 (XLC) 67,115 (Limited) (in 2024)
Hyundai NEXO	570-611	6,3	95	440	60,135 (Blue) 63,585 (Limited) (in 2023)

Source: Hyundai Motor America, 2023, Toyota Motor, 2024

Regarding mobility, in 2021 Japanese transport company Tokyu Bus reported that the cost of refueling a hydrogen fuel cell bus was about 2.6 times that of an equivalent diesel bus, with natural gas hydrogen being the predominant use in Japan (Financial Times, 2021). According to a study by Eurac Research (cited by Hydrogen Insight, 2023), which collected daily operating data from 16 fuel cell electric buses and five battery electric buses operated by the local public transport company SASA in South Tyrol (Italy), between January 2021 and April 2022 found that, on average, battery electric buses were 2.3 times cheaper to run per kilometer than green hydrogen fuel cell equivalents. Also in January 2022, the public transport operator of the city of Montpellier (France) canceled a contract to purchase 51 buses powered by hydrogen fuel cells when it found that the operating cost was 6 times higher than that of electric buses. Furthermore, the cost of fuel cell powered buses was €150,000-200,000 higher than the cost of battery-powered buses (CleanTechnica, 2022).

Refueling and transport infrastructure

Widespread adoption of HFCEVs will require new refueling infrastructure to support it. An essential condition for the development of hydrogen-based mobility is safe, compact, lightweight and cost-effective hydrogen storage (Abe et al., 2019). There are several storage methods that can support the development of hydrogen-based mobility in perspective, such as liquefied hydrogen, compressed hydrogen, cryo-compressed hydrogen, physically adsorbed hydrogen, metal hydrides, complex hydrides or liquid organic hydrides (Usman, 2022). Today, the most used solution is the storage of hydrogen in gaseous form at high pressure.

According to H2stations.org (an information service of Ludwig-Bölkow-Systemtechnik), the most comprehensive website for information on hydrogen refueling stations globally, at the end of 2023, 921 stations were in operation worldwide, with 85 of stations more than in 2022. A hydrogen refueling infrastructure, in operation or under construction, was in 40 countries. Europe had 265 hydrogen stations, of which 105 were in Germany, 51 in France, 22 in the Netherlands and 17 in Switzerland. Furthermore, at the end of 2023, there were 166 stations in Japan, 174 in South Korea, and at least 197 in China. There were 100 stations in North America, of which 92 were in the United States (75 in California) and 8 in Canada.

The number of hydrogen refueling stations is expected to exceed 10,000 by the end of the current decade (S&P Global, 2020). In the European Union, the recently adopted Alternative Fuels Infrastructure Regulation requires hydrogen refueling stations to be installed every 200 km of the trans-European transport network. South Korea and Japan also plan to expand their networks to more than 600 stations each by 2030 (Hydrogen Council-McKinsei & Company, 2023).

Large-scale deployment of hydrogen will also need to be supported by an efficient storage and transportation system. There are currently 5000 km of hydrogen pipelines in operation, mainly in the United States and Europe. Most are closed systems owned by large hydrogen producers near industrial consumers (mainly refineries and chemical plants). The largest hydrogen network in Europe and the second in the world after the United States, of about 600 km, is in Belgium and is owned by Air Liquide. It is connected to networks in France and the Netherlands. Using existing natural gas pipelines can significantly reduce the cost of setting up hydrogen networks. A proven technology since the early 1970s is hydrogen storage in salt mines. Four hydrogen salt mines are currently operational, three in the United States and one in the United Kingdom (IEA, 2023a, IEA , 2021b).

The impact on the environment

Although hydrogen fuel cell vehicles do not emit carbon dioxide or pollute the air during use, the production of hydrogen and other associated production processes are responsible for a wide range of emissions, depending on the technology and energy source used (Granovskii et al., 2006, Offer et al., 2011, Cetinkaya et al., 2012, Yoo et al., 2018, Wang et al., 2020, Ravi, Aziz, 2022, Halder et al., 2024).

Currently, most of the hydrogen is obtained from fossil fuels, mainly natural gas. Greenhouse gas emissions are significantly lower for fossil fuel-based hydrogen with carbon capture and storage or electricity-based hydrogen (EC, 2020). For electricity-based hydrogen, life-cycle greenhouse gas emissions depend on how the electricity is produced (Offer et al., 2011, Halder et al., 2024). In the case of hydrogen obtained by electrolysis of water using grid electricity, produced mostly from fossil fuels, the well-to-wheel greenhouse gas emissions of HFCEVs are higher than those of gasoline vehicles (Wang et al., 2020). Green hydrogen has the lowest life-cycle greenhouse gas emissions. In 2022, as hydrogen was produced almost exclusively from fossil fuels, hydrogen production was responsible for approximately 900 million tonnes of carbon dioxide emissions (IEA, 2023a).

Strategies for the development of hydrogen-based technologies

According to the International Energy Agency (2021), to achieve the goal of net-zero carbon dioxide emissions by 2050, necessary to limit the increase in global temperature to 1.5 °C in accordance with the Paris Agreement, measures will be necessary to transform the energy system, such as increasing energy efficiency, changing consumption behavior, electrification, or expansion of renewable sources. The importance of hydrogen is reflected in its increasing share in final energy consumption. If in 2020, hydrogen and hydrogen-based fuels account for less than 0.1% of energy consumption, in 2050 its share is expected to rise to 10%.

According to the Net Zero Emissions by 2050 Scenario, by 2030 total hydrogen production must reach well over 200 million tons, of which 70% using low-carbon technologies (electrolysis or fossil fuels with carbon capture and storage). Hydrogen production must then increase to more than 500 million tonnes by 2050, based entirely on low-carbon technologies. Achieving these targets will require an increase in installed electrolysis capacity from 1.1 GW (in 2023) to nearly 850 GW by 2030 and to nearly 3600 GW by 2050 (IEA, 2021b).

By September 2022, 41 governments, accounting for nearly 80% of global energy-related carbon dioxide emissions, have adopted hydrogen strategies, which are key in financing (IEA, 2023a). Many strategies include targets for the adoption of hydrogen technologies, most of which focus on implementing low-carbon hydrogen production. In July 2020, the European Commission adopted a strategy on hydrogen in Europe (COM(2020)0301), which introduces as objectives the increase in electrolysis capacity to at least 40 GW to produce green hydrogen (i.e., 10 million tonnes) by 2030 and its widespread use from 2030. Green hydrogen is at the heart of the strategy, given that it has the greatest decarbonization potential and is therefore most compatible with the EU's climate neutrality objective (EC, 2020). To support hydrogen-based mobility, some countries (such as China, South Korea or Ireland) have offered subsidies for the purchase of HFCEVs and the development of hydrogen refueling stations.

Hydrogen technologies need investment to become truly viable. According to the Hydrogen Council-McKinsei & Company (2023), to date, investments committed to hydrogen end-uses have reached over $7.5 billion, of which $4.5 billion in Europe. The largest amounts were invested in the field of mobility ($4.5 billion), followed by the energy sector ($1.2 billion). Globally, 1,418 clean hydrogen projects have been announced by October 2023, of which 1,011 are planned for full or partial implementation by 2030. These projects mean investments of $570 billion and 45 million tons/year of clean hydrogen by 2030. The most projects were announced in Europe (540), followed by North America (248). Announced investments are geared towards clean hydrogen production and supply (about 75%), while infrastructure and end-use investments account for only about 10% and 15%, respectively. Although investments of $570 billion by 2030 have been announced, around $430 billion of investment projects are still needed by 2030 (i.e., 45% of the total requirement) to be in line with the Hydrogen for Net-Zero Scenario.

CONCLUSIONS

In the context of climate change, which already produces serious effects on the environment and human society, but also for other reasons, such as air pollution, urgent measures are needed to reduce greenhouse gas emissions and other noxes in the transport sector. Hydrogen-based mobility, although it currently has a minimal share in the transport sector, could represent a potential alternative to means of transport that use fossil fuels, as the impact on the climate is significantly lower if the production process of hydrogen uses renewable electricity.

However, hydrogen's potential to reduce carbon dioxide emissions depends largely on how it is produced. As electrolysis capacity increases and becomes more efficient, the production cost of hydrogen is expected to decrease, being closely related to the cost of renewable energy. If the cost of renewable electricity (especially solar and wind) continues to fall, interest in green hydrogen could increase. Currently, the use of hydrogen has the greatest advance in the field of road transport, but there are concerns about the implementation of hydrogen-based technologies in the other sectors of transport (rail, sea or air).

Although research and development programs in the field of hydrogen-based mobility have been underway for several decades, the technologies in the field have not yet reached maturity. Thus, research and development must continue at a sustained pace to increase the competitiveness of HFCEVs, which depends on the production cost of hydrogen and other technological costs, such as the cost of fuel cells. To really take hold also requires investment in the supporting infrastructure to enable easy refueling.

The transition to hydrogen-based mobility requires increased investment in green hydrogen production and supporting infrastructure. For a faster rate of growth, increased actions are needed to encourage new development projects, provide clear political signals in the direction of mobility and raise awareness among the population about the ecological role of this type of mobility.

REFERENCES

Abe, J.O., Popoola, A.P.I., Ajenifuja, E., Popoola, O.M. (2019). Hydrogen energy, economy and storage: Review and recommendation. *International Journal of Hydrogen Energy*, 44(29), 15072-15086. DOI:10.1016/j.ijhydene.2019.04.068

Airbus (2024). ZEROe. Towards the world's first hydrogen-powered commercial aircraft. https://www.airbus.com/en/innovation/low-carbon-aviation/hydrogen/zeroe (Last accessed 18.06.2024).

Alstom (2024). Alstom Coradia iLint – the world's 1st hydrogen-powered passenger train. http://www.alstom.com/solutions/rolling-stock/alstom-coradia-ilint-worlds-1st-hydrogen-powered-passenger-train (Last accessed 3.06.2024).

Boeing (2024). Hydrogen and Sustainable Aviation. https://www.boeing.com/content/dam/boeing/boeing-dotcom/principles/sustainability/assets/pdf/Hydrogen_Factsheet.pdf (Last accessed 18.06.2024).

Blackridge Research & Consulting (2024). Global Top 10 Hydrogen Fuel Cell Truck Companies [2023]. https://www.blackridgeresearch.com/blog/list-of-top-hydrogen-fuel-cell-truck-fct-companies-oems-makers-manufacturers-suppliers#beiqi-foton-motor-co.,-ltd. (Last accessed 6.06.2024).

BMW Group (2023). Launch of the BMW iX5 Hydrogen pilot fleet. https://www.bmwgroup.com/en/news/general/2023/BMWiX5Hydrogen.html (Last accessed 18.05.2024).

Business Standard (2024). Zero-emission hydrogen ferry launched by PM op ave way for green transport. https://www.business-standard.com/industry/news/zero-emission-hydrogen-ferry-launched-by-pm-to-pave-way-for-green-transport-124022800799_1.html (Last accessed 7.06.2024).

Carbon Credits (2023). Toyota to Sell 200,000 Hydrogen-Powered Vehicles, Targets China & Europe Market. https://carboncredits.com/toyota-200000-hydrogen-powered-vehicles-targets-china-europe-markets/ (Last accessed 18.05.2024).

Cetinkaya, E., Dincer, I., Naterer, G.F. (2012). Life cycle assessment of various hydrogen production methods. International Journal of Hydrogen Energy, 37(3), 2071-2080. DOI:10.1016/j.ijhydene.2011.10.064

CleanTechnica (2022). French City Cancels Hydrogen Bus Contract, Opts For Electric Buses. https://cleantechnica.com/2022/01/11/french-city-cancels-hydrogen-bus-contract-opts-for-electric-buses/ (Last accessed 17.06.2024).

EC/European Commission (2020). Commission communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A hydrogen strategy: for a climate neutral Europe. Brussels. https://eur-lex.europa.eu/legal-content/RO/TXT/?uri=CELEX-%3A52020DC0301 (Last accessed 17.06.2024).

Das, H.S., Tan, C.W., Yatim, A.H.M. (2017). Fuel cell hybrid electric vehicles: A review on power conditioning units and topologies. Renewable and Sustainable Energy Reviews, 76, 268-291. DOI:10.1016/j.rser.2017.03.056.

Dépature, C., Macías, A., Jácome, A., Boulon, L., Solano, J.,Trovão, J.P. (2020). Fuel cell/supercapacitor passive configuration sizing approach for vehicular applications. *International Journal of Hydrogen Energy,* 45(50), 26501-26512. DOI:10.1016/j.ijhydene.2020.05.040.

Dunn, S. (2002). Hydrogen futures: toward a sustainable energy system. *International Journal of Hydrogen Energy*. 27(3), 235-264. DOI:10.1016/S0360-3199(01)00131-8

Dutta, S. (2014). A review on production, storage of hydrogen and its utilization as an energy resource. *Journal of Industrial and Engineering Chemistry*, 20(4), 1148-1156. DOI:10.1016/j.jiec.2013.07.037

Eudy, L., Chandler, K., Gikakis, C. (1997). Fuel Cell Buses in U.S. Transit Fleets: Summary of Experiences and Current Status. National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy07osti/41967.pdf (Last accessed 14.06.2024).

Fayaz, H., Saidur, R., Razali, N., Anuar, F.S., Saleman, A.R., Islam, M.R. (2012). An overview of hydrogen as a vehicle fuel. *Renewable and Sustainable Energy Reviews*, 16(8), 5511-5528. DOI:10.1016/j.rser.2012.06.012

Financial Times (2021). High costs dog Tokyo's hydrogen buses. https://www-ft-com.ezproxy.depaul.edu/content/2b9dd655-6b64-416c-a83f-1fe1002da7d5 (Last accessed 17.06.2024).

FCHEA - Fuell Cell & Hydrogen Energy Association (2024). Fuel Cell Basics. https://www.fchea.org/fuelcells (Last accessed 8.08.2024).

Fragiacomo, P., Genovese, M. (2020). Technical-economic analysis of a hydrogen production facility for power-to-gas and hydrogen mobility under different renewable sources in Southern Italy. *Energy Conversion and Management*, 223, 113332. DOI:10.1016/j.enconman.2020.113332.

Fuel Cell Electric Buses (2024). Projects. https://www.fuelcellbuses.eu/. (Last accessed 7.11.2024).

Granovskii, M., Dincer, I., Rosen, MA. (2006). Life cycle assessment of hydrogen fuel cell and gasoline vehicles. *International Journal of Hydrogen Energy*, 31(3), 337-352. DOI: 10.1016/j.ijhydene.2005.10.004.

Gurz, M., Baltacioglu, E., Hames Y., Kaya K. (2017). The meeting of hydrogen and automotive: A review. *International Journal of Hydrogen Energy*, 42(36), 23334-23346. DOI:10.1016/j.ijhydene.2017.02.124

Halder, P., Babaie, M., Salek F., Shah K., Stevanovic S., Bodisco, T.A., Zare, A. (2024). Performance, emissions and economic analyses of hydrogen fuel cell vehicles, *Renewable and Sustainable Energy Reviews*, 199. DOI:10.1016/j.rser.2024.114543

Honda Motor Co. Ltd. (2024). Honda's Expanding Hydrogen Strategy - Taking FCEV Technology to New Domains. https://global.honda/en/stories/057.html (Last accessed 23.06.2024).

H2stations.org (2024). Europe is increasingly adapting its growing hydrogen refuelling infrastructure to include heavy-duty vehicle refuelling,16th Annual assessment of H2stations.org by LBST (Ludwig-Bölkow-Systemtechnik GmbH). https://www.h2stations.org/press-release-2024-europe-is-increasingly-adapting-its-growing-hydrogen-refuelling-infrastructure-to-include-heavy-duty-vehicle-refuelling/ (Last accessed 10.06.2024).

Hydrogen Council-McKinsei&Company (2023). Hydrogen Insights 2023. The state of the global hydrogen economy, with a deep dive into renewable hydrogen cost evolution. https://hydrogencouncil.com/wp-content/uploads/2023/12/Hydrogen-Insights-Dec-2023-Update.pdf (Last accessed 20.05.2024).

Hydrogen Insight (2024a). Only two hydrogen cars sold in South Korea last month, despite subsidies offering 50% discounts. https://www.hydrogeninsight.com/transport/only-two-hydrogen-cars-sold-in-south-korea-last-month-despite-subsidies-offering-50-discounts/2-1-1602437 (Last accessed 9.06.2024).

Hydrogen Insight (2024b). World record | Hydrogen train travels nearly 3,000km without refuelling. https://www.hydrogeninsight.com/transport/world-record-hydrogen-train-travels-nearly-3-000km-without-refuelling/2-1-1617599 (Last accessed 7.06.2024).

Hydrogen Insight (2024c). China's first hydrogen passenger train completes tests, with similar ranges and speeds to European models. https://www.hydrogeninsight.com/transport/china-s-first-hydrogen-passenger-train-completes-tests-with-similar-ranges-and-speeds-to-european-models/2-1-1616800 (Last accessed 7.06.2024).

Hydrogen Insight (2023). Real-world figures | Hydrogen buses cost 2.3 times more to run per km than battery electric ones, says Italian study. https://www.hydrogeninsight.com/transport/real-world-figures-hydrogen-buses-cost-2-3-times-more-to-run-per-km-than-battery-electric-ones-says-italian-study/2-1-1511785?zephr_sso_ott=jP4MzU (Last accessed 14.06.2024)

Hyundai Motor America (2023). Nexo Fuel Cell Specifications. https://www.hyundaiusa.com/us/en/vehicles/nexo/compare-specs (Last accessed 4.07.2024).

Hyundai Motor Company (2020). A History of Hyundai and Fuel Cell Technology. https://www.hyundai.news/uk/articles/press-releases/a-history-of-hyundai-and-fuel-cell-technology.html (Last accessed 15.05.2024).

International Energy Agency (2023a). Global Hydrogen Review 2023. https://iea.blob.core.windows.net/assets/ecdfc3bb-d212-4a4c-9ff7-6ce5b1e19cef/GlobalHydrogenReview2023.pdf (Last accessed 31.05.2024).
IEA (2023b). Global EV Data Explorer. https://www.iea.org/data-and-statistics/data-tools/global-ev-data-explorer (Last accessed 23.01.2023).
IEA (2021a). Global Hydrogen Review 2021. https://iea.blob.core.windows.net/assets/5bd46d7b-906a-4429-abda-e9c507a62341/GlobalHydrogenReview2021.pdf (Last accessed 21.06.2022)
IEA (2021b). Hydrogen, IEA, Paris https://www.iea.org/reports/hydrogen (Last accessed 4.07.2022)
IEA (2019). The Future of Hydrogen, IEA, Paris https://www.iea.org/reports/the-future-of-hydrogen (Last accessed 4.07.2022)
Jain, I.P. (2009). Hydrogen the fuel for the 21st century. *International Journal of Hydrogen Energy*, 34(17), 7368-7378. DOI:10.1016/j.ijhydene.2009.05.093
Kim, I., Kim, J., Lee, J., (2020). Dynamic analysis of well-to-wheel electric and hydrogen vehicles greenhouse gas emissions: Focusing on consumer preferences and power mix changes in South Korea. *Applied Energy*, 260, 114281. DOI:10.1016/j.apenergy.2019.114281
Larsson, M., Mohseni, F., Wallmark, C., Grönkvist, S., Alvfors, P. (2015). Energy system analysis of the implications of hydrogen fuel cell vehicles in the Swedish road transport system. *International Journal of Hydrogen Energy*, 40(35), 11722-11729. DOI:10.1016/j.ijhydene.2015.04.160
Lee, D.Y., Elgowainy, A., Kotz, A., Vijayagopal, R., Marcinkoski, J. (2018). Life-cycle implications of hydrogen fuel cell electric vehicle technology for medium- and heavy-duty trucks. *Journal of Power Sources*, 393, 217-229. DOI:10.1016/j.jpowsour.2018.05.012
Marquordt, C. (2024). Europe's largest operator of hydrogen buses – and now also with articulated buses: RVK in the Cologne/Bonn region. *Urban Transport Magazine*. https://www.urban-transport-magazine.com/en/europes-largest-operator-of-hydrogen-buses-and-now-also-with-articulated-buses-rvk-in-the-cologne-bonn-region/. (Last accessed 7.11.2024).
Mercedes-Benz Group (2024). Mercedes-Benz GLC F-CELL (model series X 253). https://group.mercedes-benz.com/responsibility/sustainability/climate-environment/environmental-check/glc-f-cell.html (Last accessed 11.06.2024).
MIT/Massachusetts Institute of Technology (2023). Climate Portal. Why have electric vehicles won out over hydrogen cars (so far)?. https://climate.mit.edu/ask-mit/why-have-electric-vehicles-won-out-over-hydrogen-cars-so-far (Last accessed 22.06.2024).
Nam X (2024). The NamX Concept. https://www.namx-hydrogen.com/en/namx-hydrogen-car (Last accessed 11.06.2024).
Nikkei (2024). Japan pushes for hydrogen trains on local lines, revamping safety rules. https://asia.nikkei.com/Business/Transportation/Japan-pushes-for-hydrogen-trains-on-local-lines-revamping-safety-rules (Last accessed 7.06.2024).
Norled (2024). MF Hydra sails on zero-emission liquid hydrogen. https://www.norled.no/en/mf-hydra-sails-on-zero-emission-liquid-hydrogen/ (Last accessed 7.06.2024).
Offer, G.J., Contestabile, M., Howey, D.A., Clague, R., Brandon, N.P. (2011). Techno-economic and behavioural analysis of battery electric, hydrogen fuel cell and hybrid vehicles in a future sustainable road transport system in the UK. *Energy Policy*, 39(4), 1939-1950. DOI:10.1016/j.enpol.2011.01.006.
Power Technology (2023). San Francisco welcomes world's first hydrogen-powered commercial ferry. https://www.power-technology.com/news/san-francisco-welcomes-worlds-first-hydrogen-powered-commercial-ferry/?cf-view&cf-closed (Last accessed 7.06.2024).
PwC (2022). Analysing the future cost of green hydrogen. https://www.pwc.com/gx/en/issues/esg/the-energy-transition/analysing-future-cost-of-green-hydrogen.html (Last accessed 10.06.2024)
Ravi, S.S., Aziz, M. (2022). Clean hydrogen for mobility – Quo vadis? *International Journal of Hydrogen Energy*, 47(47), 20632-20661. DOI: 10.1016/j.ijhydene.2022.04.158.

Ren, P., Pei, P., Li, Y., Wu, Z., Chen, D., Huang, S. (2020). Degradation mechanisms of proton exchange membrane fuel cell under typical automotive operating conditions. *Progress in Energy and Combustion Science*, 80. DOI:10.1016/j.pecs.2020.100859

SAIC Motor (2020). SAIC Motor unveils hydrogen strategy plan. https://www.saicmotor.com/english/latest_news/saic_motor/54083.shtml (Last accessed 11.06.2024).

Siemens Mobility (2024). Mireo Plus H – The next generation of hydrogen trains. https://www.mobility.siemens.com/global/en/portfolio/rolling-stock/commuter-and-regional-trains/mireo/mireo-plus-h.html (Last accessed 7.06.2024).

Solaris Bus & Coach, 2024. First Solaris articulated hydrogen buses already in the RVK fleet from Cologne. https://www.solarisbus.com/en/press/first-solaris-articulated-hydrogen-buses-already-in-the-rvk-fleet-from-cologne-2199 (Last accessed 8.11.2024).

Soleimani, A., Dolatabadi, SHH., Heidari, M., Pinnarelli, A., Khorrami, BM., Luo, Y., Vizza, P., Brusco, G. (2024). Progress in hydrogen fuel cell vehicles and up-and-coming technologies for eco-friendly transportation: an international assessment. *Multiscale and Multidisciplinary Modeling, Experiments and Design*, 7, 3153–3172.

S&P Global (2020). Fuel cell EVs set to top 13 million by 2030 as hydrogen scales up: Hydrogen Council. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/electric-power/012420-fuel-cell-evs-set-to-top-13-million-by-2030-as-hydrogen-scales-up-hydrogen-council (Last accessed 8.05.2024).

SNCF Groupe (2024). First hydrogen TERs arriving in stations in 2025. https://www.groupe-sncf.com/en/innovation/decarbonization-trains/hydrogen-ter (Last accessed 3.06.2024).

Statista (2023). Global fuel cell electric vehicle fleet in selected countries as of 2022, by vehicle segment. https://www.statista.com/statistics/1387835/global-fcev-stock-in-selected-country-by-vehicle-segment/ (Last accessed 30.05.2024).

Tanç, B., Arat, HT., Baltacıoğlu, E., Aydın, K. (2019). Overview of the next quarter century vision of hydrogen fuel cell electric vehicles. *International Journal of Hydrogen Energy*, 44(20), 10120-10128. DOI:10.1016/j.ijhydene.2018.10.112.

The Advanced Propulsion Centre UK (2004). The green Wrightbus: a UK export success story. https://www.apcuk.co.uk/impact/case-studies/wrightbus-export-success/ (Last accessed 14.06.2024).

The Asahi Shimbun (2024). Test runs of first hydrogen hybrid train in nation chugging along. https://www.asahi.com/ajw/articles/15182593 (Last accessed 7.06.2024).

The Chemical Engineer (2012). Francis Bacon - Future Fuel. https://www.thechemicalengineer.com/features/cewctw-francis-bacon-future-fuel/ (Last accessed 8.08.2024).

Toyota Motor Sales, USA (2024). Mirai Full Specs. https://www.toyota.com/mirai/features/ (Last accessed 4.07.2024).

Toyota Motor Corporation (2018). Toyota moves to expand mass-production of fuel cell stacks and hydrogen tanks towards ten-fold increase post-2020. https://global.toyota/en/newsroom/corporate/22647198.html (Last accessed 17.05.2024).

Toyota Motor Corporation (2001). Toyota Jointly Develops Fuel Cell Hybrid Bus, the FCHV-BUS1. https://global.toyota/en/detail/211744 (Last accessed 14.06.2024)

Universal Hydrogen (2023). Universal Hydrogen Successfully Completes First Flight of Hydrogen Regional Airliner. https://hydrogen.aero/press-releases/universal-hydrogen-successfully-completes-first-flight-of-hydrogen-regional-airliner/ (Last accessed 18/06.2024).

Usman, MR. (2022). Hydrogen storage methods: Review and current status. *Renewable and Sustainable Energy Reviews*, 167, 112743. DOI:10.1016/j.rser.2022.112743.

Veziroğlu, T.N., Şahin, S. (2008). 21st Century's energy: Hydrogen energy system. *Energy Conversion and Management*, 49, 7, 1820-1831. DOI:10.1016/j.enconman.2007.08.015

Villar, J., Olavarría, B., Doménech, S., Campos, F.A. (2020). Costs Impact of a Transition to Hydrogen-fueled Vehicles on the Spanish Power Sector. *Utilities Policy*, 66, 101100. DOI:10.1016/j.jup.2020.101100.

Wang, G., Huang, F., Yu, Y., Wen, S., Tu, Z. (2018). Degradation behavior of a proton exchange membrane fuel cell stack under dynamic cycles between idling and rated condition. *International Journal of Hydrogen Energy,* 43(9), 4471-4481. DOI:10.1016/j.ijhydene.2018.01.020.

Wang, Q., Xue, M., Lin, B.L., Lei, Z., Zhang, Z. (2020). Well-to-wheel analysis of energy consumption, greenhouse gas and air pollutants emissions of hydrogen fuel cell vehicle in China. *Journal of Cleaner Production,* 275. DOI:10.1016/j.jclepro.2020.123061.

Yoo, E., Kim, M., Song, H.H. (2018). Well-to-wheel analysis of hydrogen fuel-cell electric vehicle in Korea. *International Journal of Hydrogen Energy,* 43(41), 19267-19278. DOI:10.1016/j.ijhydene.2018.08.088

Zhao, J., Li, X. (2019). A review of polymer electrolyte membrane fuel cell durability for vehicular applications: Degradation modes and experimental techniques. *Energy Conversion and Management,* 199. DOI:10.1016/j.enconman.2019.112022

ZeroAvia (2024). ZeroAvia Flight Testing Hydrogen-Electric Powerplant. https://zeroavia.com/flight-testing/ (Last accessed 18/06.2024).

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ADAPTATION STRATEGIES TO COPE WITH THE EFFECTS OF CLIMATE VARIABILITY IN THE CENTRAL PLATEAU REGION OF BURKINA FASO

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ABSTRACT

Climate variability presents major challenges across Africa, particularly in Burkina Faso. This article analyses the adaptation strategies implemented by local populations and development actors to cope with this phenomenon in the Central Plateau region. Conducted in October 2023 in three villages in the region, the research combines field observations, semi-structured interviews and documentary research. The results reveal a range of coping strategies adopted by local people. In agriculture, these include the use of short-cycle varieties, the planting of trees to counter the high heat, and soil conservation techniques to combat drought. Livestock farmers have also developed strategies such as transhumance and the construction of shelters adapted to the climate. In market gardening, the use of compost and innovative irrigation techniques is widespread. Development players, particularly technical services and NGOs, are supporting these initiatives by promoting sustainable agricultural practices and encouraging the construction of resilient infrastructure. This article thus highlights the importance of local adaptation to climate change and the crucial role of development players in strengthening community resilience to climate variability.

Keywords: *Climate variability, adaptation strategies, Central Plateau region, Burkina Faso.*

INTRODUCTION

Climate variability, characterised by short- and long-term fluctuations in weather and climate conditions, represents a major challenge for contemporary societies. The effects of this variability manifest themselves in a series of impacts on natural and human systems, including an increase in the frequency and intensity of extreme events such as heat waves, floods and droughts. These events disrupt ecosystems, agriculture, the economy and public health, requiring robust adaptation strategies to mitigate their effects and promote resilience. In this context, strategies for adapting to climate variability are measures taken to anticipate and reduce the negative impacts of this phenomenon while taking advantage of the opportunities they may offer.

Climate variability poses significant challenges throughout the world, and particularly in Africa. Because of its economic dependence on agriculture, its vulnerable infrastructure and the diversity of its ecosystems, the African continent is particularly sensitive to the effects of this variability. Therefore, adaptation strategies are crucial for mitigating the negative impacts and strengthening the resilience of African populations. In-

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deed, agriculture is the sector most affected by climate variability in Africa, with direct impacts on food security (Mbow et al., 2019). Regarding adaptation in urban areas, these areas in Africa face unique challenges due to their rapid growth and often inadequate infrastructure (Taylor and Ziervogel, 2017, Simon and Parnell, 2019). In this context, effective governance and appropriate public policies are essential for the successful implementation of adaptation strategies (Tindyebwa and Mulwal., 2021). Furthermore, Mungai and Gachene (2017) highlight that innovative technologies offer new opportunities to improve climate resilience in Africa. In addition, Chanza and Nhapi (2016) show that adaptation strategies must also include social and community dimensions to be fully effective on the continent. Similarly, Nyasimi and Amwata (2019) highlight the role of women in adaptation efforts. Women play a crucial role in natural resource management and food security, and their involvement in decision-making processes can lead to more sustainable and equitable solutions in Africa.

In Burkina Faso, the consequences of climate variability threaten to slow down socio-economic progress, wipe out years of development efforts and jeopardise livelihood support systems, particularly at the local level (Zoma and Tarama, 2022). Given this reality, the need to adapt to the effects of this recurring phenomenon has become apparent for Burkina Faso as a whole, and in particular for its territorial entities such as regions and communes (Zoma and Tarama, 2021). This study therefore examines the adaptation strategies of local populations and development stakeholders in response to climate variability in the Central Plateau region of Burkina Faso.

RESEARCH METHODOLOGY

The study was carried out in October 2023 in the Central Plateau region of Burkina Faso in West Africa (Figure 1), specifically in three villages: Kouila and Monebtenga in the municipality of Ziniaré and Goundry in the municipality of Loumbila.

The climate in this region is mainly Sudano-Sahelian, characterised by a long dry season from October to May, followed by a rainy season from June to September.

In view of the research theme of climate variability, these villages were chosen because they are mainly inhabited by farmers in Kouila, livestock breeders in Monebtenga and market gardeners in Goundry. Primary data collection in these three villages involved field observations, using a camera for documentation, as well as semi-structured interviews guided by interview questionnaires. A total of thirty-five (35) people were interviewed, including fifteen (15) in Goundry, nine (09) in Kouila and eleven (11) in Monebtenga. The selection of participants was based on a reasoned selection to ensure that the interviewees could provide relevant accounts of their perceptions of the adverse effects of climate variability on key activities in the region.

Interviews were conducted with local development stakeholders, in particular representatives of decentralised state structures such as the Ministry of Agriculture, Animal Resources and Fisheries, the Ministry of the Environment, Water and Sanitation, and the NGO APIL, which supports rural communities in Burkina Faso. Interview questionnaires were also distributed to households engaged in agriculture, livestock breeding and/or market gardening, with the aim of gathering their perceptions of climate variability and its impacts in the Central Plateau region. The purpose of these interviews was to explore the adaptation strategies implemented by local populations in the farming, livestock-raising and market-gardening sectors in response to climate fluctuations. Additionally, the interviews aimed to identify the adaptation mechanisms adopted by other development players in the region.

The data from the interviews were transcribed and supplemented by documentary research, in order to gain a better understanding of the perceptions and impacts of climate variability in these three villages in the Central Plateau region of Burkina Faso.

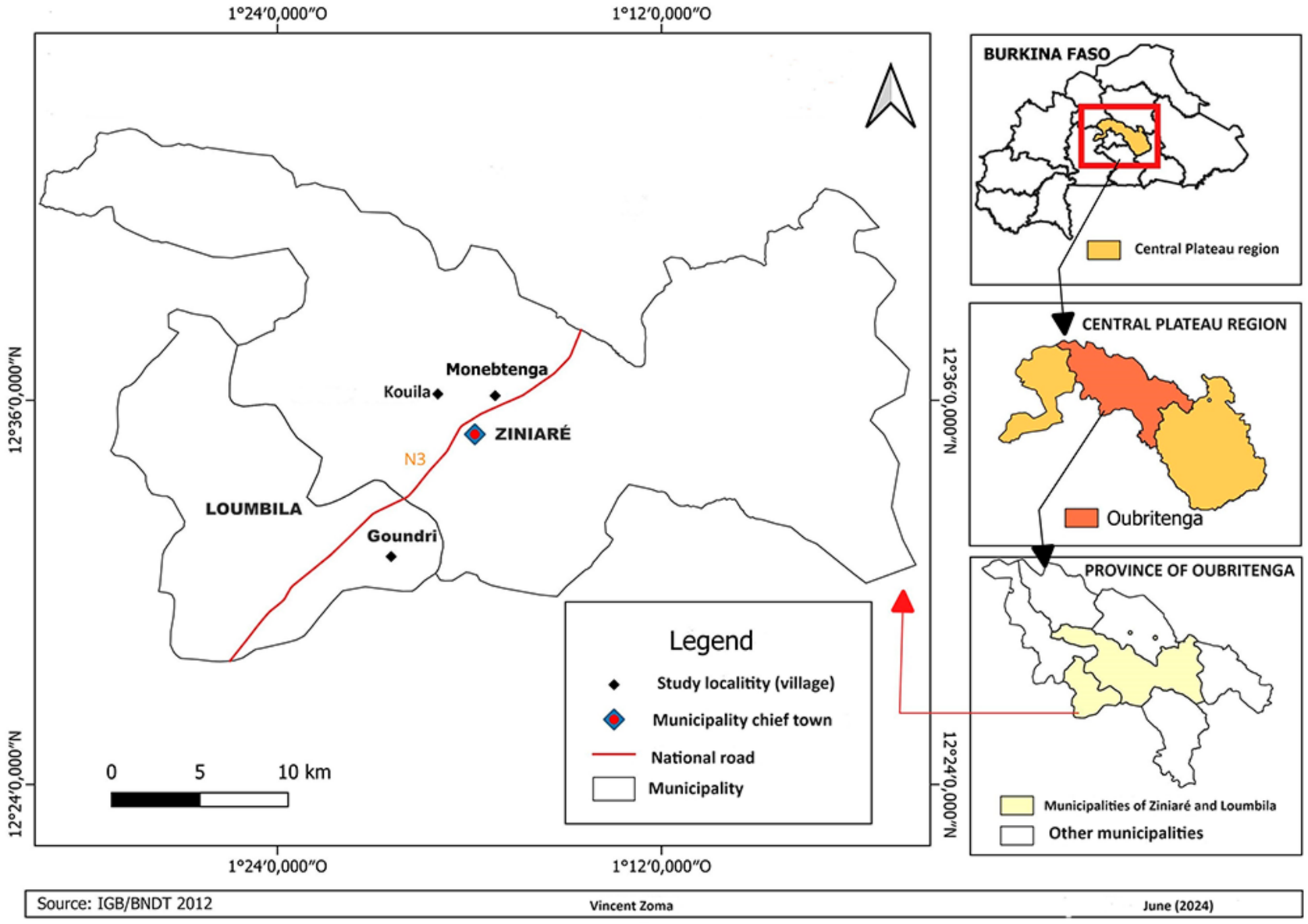

Figure 1. Location of the study area in the Central Plateau region

RESULTS

Adaptation strategies emanate on the one hand from local populations and, on the other, are mainly the result of contributions from development actors in the region, intending to benefit the communities.

Local Communities' Adaptation Strategies

Communities of farmers, herders and market gardeners have developed various strategies to counter the adverse effects of climate variability in the Central Plateau region of Burkina Faso.

In agriculture, farmers have adopted a number of farming practices to cope with climate hazards. Interviews with farmers show that they have abandoned certain crops that have proved incapable of withstanding climatic variations. Similarly, long-cycle varieties have been replaced by short-cycle varieties due to recurrent droughts, reduced rainfall and the impoverishment of fertile soils. For example, a group of farmers in Kouila report that they have *'abandoned crops such as the old maize, nebié (beans), white sorghum and red sorghum, which require 80, 70 and 90 days respectively for their growth cycles'*. This transition is motivated by the delay in the onset of the rains and their early cessation, encouraging the adoption of varieties with shorter growing times, often improved varieties. In this context, the use of these varieties remains a preferred option for farmers to compensate for the late start to the rainy season. In addition, some communities have planted trees to cope with the hot weather, although this practice is still not widespread.

In addition, according to the technical services in charge of agriculture and livestock in the region, as well as the households interviewed in the three villages, water and soil conservation techniques, such as the use of manure and compost, are widespread in the region. These techniques are aimed at coping with periods of drought, fluctuations in rainfall, flooding of fields and the late start and early end of the rainy seasons. Livestock farming is also increasingly integrated into agriculture, notably through the use of compost (Figure 2).

Figure 2. A compost heap

Source: Gouvernorat du Plateau Central (2023)

Figure 2 shows a pile of compos made from grass and animal waste. The organic manure is obtained by fermentation after watering. Animal droppings and household waste are used to produce this organic manure.

In the livestock sector, farmers are forced to adopt new approaches in the face of climatic hazards. According to interviews conducted with livestock farmers in the three villages, their resilience strategies vary according to their means of subsistence. For example, these farmers retain crop residues after harvesting to feed their livestock (Figure 3).

The maize residues, collected in piles and illustrated in Figure 3, are placed on a tree to provide food for the animals during the dry season.

In this region, transhumance is also emerging as a strategy for adapting to the effects of climatic variability. This practice involves the seasonal movement of herds to reach areas where they can feed or bring the same herd back to its original location when environmental conditions are favourable for livestock rearing.

Farmers in the region turn to veterinary services for expert advice on reducing animal morbidity. They also use available resources to build shelters to protect their animals from damage caused by heavy rain, particularly when raising pigeons (Figure 4).

Figure 3. Conservation of maize crop residues in Monebtenga

Source: Author (2023)

Figure 4. Pigeon shelters on a tree in Monebtenga

Source: author (2023)

These shelters, made from cans, offer domestic pigeons shelter from heavy rain. As shown in Figure 4, these cans have to be carefully positioned to prevent them from falling due to the wind and heavy rain.

In addition, in the field of market gardening, local people are implementing strategies to continue their activities despite the challenges posed by climate variability. They are using compost as a technique for soil and water conservation. Faced with water shortages, some people are using machines to draw water from the Loumbila dam. In addition, to mitigate the damage caused by strong winds that can break or uproot plants, they sow other large crops, such as maize or millet, among vegetable plants such as tomatoes (*Solanum lycopersicum* L.), aubergines (*Solanum melongena* L.) and spinach (*Spinacia oleracea*), as shown in Figure 5.

Figure 5 shows an aubergine crop grown alongside maize. The maize plants are not yet as developed as the aubergine plants. By diversifying into market gardening, this approach not only protects crops but also enables local people to increase their food production.

Overall, faced with the effects of climate variability, local communities in the region are implementing a number of resilience strategies. These include the use of adapted varieties, the application of soil and water conservation techniques (CES/DRS) and the planting of trees in the agricultural sector. They also include the use of crop residues, the construction of adapted shelters, the practice of transhumance and the use of veterinary services in livestock farming, as well as the adoption of CES/DRS techniques, crop diversification and the use of water supply machinery in market gardening.

Figure 5. Aubergine cultivation mixed with maize at Goundry

Source: author (2023)

In addition to these strategies put in place by the local populations, the decentralised services of the State (in particular the technical services) and non-governmental organisations such as the NGO APIL, which operates in the rural sector, provide support to help these communities address the challenges posed by climate variability.

Development Actors' Adaptation Strategies

In the agricultural sector, faced with pockets of drought, flooding, heavy rainfall, irregular rainfall and the late start and early end to the season that characterise climate variability, and to complement the strategies adopted by local populations, the agricultural technical services and the NGO APIL provide support to communities by introducing them to other methods of adaptation. These technical services explain various strategies to local people, including the use of adapted varieties, the practice of off-season cultivation, the deployment of drip irrigation systems, in-line sowing techniques, the introduction of micro-irrigation, the construction of small drainage channels, reseeding, sowing in bunches, etc., which they explain in detail.

Furthermore, in the region, strategies such as natural compost, zaï, half-moon, stone cordons and 300m3 boulis are introduced to the local population by NGOs such as APIL. Natural compost is a process for producing organic matter that involves digging a hole, up to 2 to 4 metres deep, in which harvest residues (millet, sorghum or maize stalks) are buried and mixed with manure (cow dung, pig or donkey droppings). This mixture is periodically watered to speed up the decomposition of the residues. Compost improves the soil's water-holding capacity, helping to alleviate water stress in crops, which is particularly exacerbated by climate variability. It also helps to increase yields and reduce food insecurity caused by climatic fluctuations.

In addition to compost, the zaï technique is an adaptation strategy in the agricultural sector, promoted by the NGO APIL in the region (Figure 6).

The zaï method, shown in Figure 6, is a means of preventing soil degradation. It is a traditional system for restoring the fertility of compacted arid land, involving the creation of pits to concentrate run-off water and organic matter. In this way, zaï represents an approach to recovering altered land and a response to climate variability by mitigating the effects of drought on soil productivity.

The half-moon method, illustrated in the figure, involves clearing the earth to form basins a few metres high, creating mounds in the shape of half-moons.

The half-moon method is used to collect water and sediment for the benefit of crops, identify sources of fertilising organic matter and water, and preserve and optimise these resources.

Figure 6. Zaï technique

Source: Gouvernorat du Plateau central (2023)

Figure 7. Half-moon technique

Source: Gouvernorat du Plateau central (2023)

Figure 8. Stone cordon technique

Source: Gouvernorat du Plateau central (2023)

On the other hand, the stone cordon technique (Figure 8) is mainly used to reduce the damage caused to the soil by rainwater.

The stone cordon technique consists of creating a linear structure made up of a stack of stones. It enables plants to withstand pockets of drought caused by climatic variability and prevents water erosion of the soil.

The boulis technique (water retention in Mooré) in Figure 9 is a technique used to collect run-off water.

In the field of agriculture, in response to pockets of drought, flooding, heavy rainfall, irregular rainfall and the late start and early end to the seasons that are characteristic of climate variability, local people are advised and supported by the technical agricultural services and the NGO APIL in adopting various adaptation strategies. These strategies include the use of adapted crop varieties, off-season cultivation, the development of drip irrigation systems, sowing in rows, the creation of small gullies, reseeding, and sowing in bunches, among others. These methods are explained to the local people by these services.

In the same vein, the NGO APIL explains to local people practices such as the use of natural compost, the zaï method, half-moons, stone cordons and 300 m3 boulis. Natural compost, for example, consists of producing organic matter from the decomposition of crop residues and manure, helping to retain water and increase agricultural yields, thereby contributing to food security in the face of climate variability.

The zaï method, illustrated in Figure 6, aims to limit soil degradation by concentrating run-off water and organic matter in holes. Similarly, the half-moon technique, illustrated in Figure 7, captures water and sediment for crops, while preserving fertilising organic matter and water resources.

Figure 9. Bouli technique

Source: Gouvernorat du Plateau central (2023)

On the other hand, the stone cordon method, shown in Figure 8, is mainly used to mitigate the damage to the soil caused by rainwater.

Another strategy put forward, as shown in Figure 9, consists of digging ponds to increase their water storage capacity, thus facilitating the irrigation of market garden crops around these basins.

The interviews revealed that in the livestock sector, advice from regional technical services agents encourages the use of agro-industrial by-products as essential supplements to livestock feed, as well as the conservation of fodder for periods of need. Livestock farmers are also encouraged to build suitable shelters for their livestock and to set up effective drainage systems to prevent damage caused by heavy rains.

Also, according to the interviews, with regard to water resources, the technical services recommend the use of groundwater (wells) as a solution for adapting to climatic hazards. In addition, reforestation of riverbanks is encouraged to protect dams and prevent pockets of drought.

In addition, in the environmental field, the regional technical services promote the application of good agro-ecological practices and sustainable resource management. These practices include the planting of adapted species, the use of rubble stones to limit erosion, and the assisted natural regeneration approach to stimulate the growth of woody species.

Moreover, in the housing and infrastructure sector, the technical services recommend using local building materials to reduce temperature differences and improve the thermal comfort of homes, thereby helping to reduce energy requirements and the risks associated with power cuts. Projects such as the 'Village Opéra' in Ziniaré illustrate these initiatives (Figure 10).

The commune of Ziniaré, located in the Central Plateau region, is home to the housing estate shown in Figure 10. This urban complex is characterised by buildings surrounded by stone and granite, comprising

Figure 10. Village Opéra in Ziniaré built with adapted local materials

Source: Diallo (2023)

around twenty bioclimatic buildings. These structures are designed to withstand the heat, so that when it is hot inside, the temperature remains pleasant without the need for excessive ventilation.

In this region, various regional development players are supporting the adoption of numerous strategies to cope with the effects of climate variability. In agriculture, these strategies include the use of water and soil conservation techniques (CES/DRS), adapted crop varieties, out-of-season crops, drip irrigation systems, in-line sowing techniques, and the construction of drainage infrastructure such as small gullies and drainage channels. In the livestock sector, strategies include the use of agro-industrial by-products, rational fodder management, the construction of suitable enclosures and shelters for livestock, animal health monitoring, as well as the promotion of fodder production and the construction of pastoral boreholes.

With regard to water resources, based on direct observations in the field, the regional councils are focusing on the use of groundwater, reforestation of riverbanks, the adoption of good integrated water management practices, the setting up of water management committees, the construction of drinking water supply infrastructures, as well as the cleaning of gutters and the opening of sluice gates for water drainage. In terms of the environment, efforts are focused on the application of good agro-ecological practices, the creation of run-off water collection basins, reforestation, limiting erosion through the use of rubble, reforestation and assisted natural regeneration.

In the field of housing and infrastructure, regional recommendations focus on the use of cover slabs for gutters, construction in non-flood-prone areas, the use of heat-resistant materials for infrastructure, and the provision of drainage and flood protection infrastructure.

All these strategies are encouraged and supported by the decentralised structures of the State and the non-governmental organisations operating in the region.

DISCUSSION

The adaptation strategies deployed by local populations and development stakeholders in the Central Plateau region of Burkina Faso in the face of climate variability are varied and meet the specific needs of the agricultural, livestock and market gardening sectors. This diversity of strategies illustrates not only the ingenuity and resilience of local populations, but also the importance of external intervention to reinforce these efforts.

In agriculture, farmers have adopted a number of practices to cope with climatic hazards. Replacing long-cycle varieties with short-cycle varieties is a direct response to the variability of rainy seasons. As Béné and al. (2014) point out, adapting crop cycles is crucial in regions where climatic conditions are uncertain and increasingly unpredictable. In addition, water and soil conservation practices, such as the use of manure and compost, are commonly used to improve soil fertility and water retention, enabling crops to better withstand droughts and heavy rainfall. Efforts to integrate agriculture and livestock farming, such as the use of compost, demonstrate an integrated approach to natural resource management. Farmers in the Central Plateau region thus illustrate the importance of agroecological solutions, which, according to Pretty et al. (2018), can improve the resilience of farming systems to climate change while increasing their productivity. Agro-ecological practices, such as reforestation and assisted natural regeneration, are encouraged to preserve biodiversity and combat soil erosion (Ouédraogo et al., 2018).

Breeders are also adopting strategies such as conserving crop residues to feed livestock during the dry season and practising transhumance to find new pastures (Yameogo et al., 2018). The construction of animal shelters, particularly for pigeons, is a measure taken to protect livestock from heavy rain and strong winds.

In market gardening, the use of compost and crop diversification to mitigate the impact of strong winds illustrates the adaptability of market gardeners. Growing taller plants to protect more vulnerable plants, such as tomatoes and aubergines, is a clever technique that demonstrates a deep understanding of the interactions between different crops and climatic conditions. These local practices align with the recommendations of the Food and Agriculture Organization of the United Nations (FAO, 2019) for sustainable agriculture that is resilient to climate shocks.

Development stakeholders, in particular government technical services and NGOs such as APIL, play a vital role in promoting advanced adaptation strategies. Support for techniques such as zaï, half-moon and stone cordons demonstrates the integration of improved traditional practices and innovations to meet current climate challenges. These techniques have proven effective in improving soil productivity and managing water resources, as highlighted by Kaboré and Reij (2004) in their work on the rehabilitation of degraded land in West Africa. In addition to agricultural techniques, initiatives such as fodder production and the organisation of competitions for the best fodder producers show a proactive approach to encouraging sustainable practices. These efforts not only support the resilience of farming systems, but also contribute to the food security of rural communities (Lal, 2016).

In addition, integrated water resource management, including riverbank reforestation and groundwater use, is crucial for the sustainability of local systems in the face of climate variation. Sustainable land management practices, such as assisted natural regeneration and the establishment of local water committees, demonstrate a systems approach to natural resource management (Rockström et al., 2010). Efforts to improve the thermal comfort of homes using locally adapted materials also demonstrate a holistic approach to climate adaptation, integrating socio-economic and cultural aspects for greater resilience (Satterthwaite and al., 2020). The use of local materials adapted to heat, such as compressed earth bricks, helps to improve the thermal comfort of buildings while reducing energy requirements (Zongo et al., 2022).

The strategies for adapting to climate variability in the Central Plateau region of Burkina Faso illustrate a combination of traditional knowledge and modern innovations supported by local and external stakeholders.

CONCLUSION

In the Central Plateau region of Burkina Faso, climate variability is putting considerable pressure on the livelihoods of local people, particularly in the farming, livestock breeding and market gardening sectors.

Faced with these challenges, local communities have developed a series of resilient adaptation strategies. In agriculture, farmers have adjusted their practices by abandoning less resistant crops and adopting short-cycle varieties that are better adapted to changing climatic conditions. They have also implemented soil and water conservation techniques such as composting and building small water reservoirs to cope with droughts and floods. The integration of livestock farming with agriculture through practices such as composting demonstrates their holistic approach to agricultural resilience. Livestock farmers have also developed intelligent strategies, notably by conserving crop residues for cattle feed during the dry season. Seasonal transhumance is another common practice, enabling herds to find suitable pastures depending on weather conditions. Farmers also benefit from the advice and health monitoring provided by the local veterinary services to keep their livestock healthy in the face of climatic challenges. In market gardening, local people use soil and water conservation techniques similar to those used in agriculture, while diversifying their crops to mitigate the risks associated with climate variability. The use of machinery to supply water and the combination of fast-growing crops with more wind-resistant ones illustrate their adaptability and creativity.

In addition to the strategies developed by local populations, development stakeholders such as technical agricultural services and NGOs play a crucial role in providing additional support and advice. Innovative techniques such as zaï, half-moon and stone cordons are being promoted to improve agricultural resilience, while initiatives such as the construction of water towers and integrated water resource management aim to strengthen water security in the region.

Overall, these adaptation strategies demonstrate the resilience and determination of local communities to face the challenges of climate variability. By combining traditional knowledge with innovative practices promoted by development players, the Central Plateau region is showing the way towards effective and sustainable adaptation to climate change. However, to ensure their long-term success, it is essential that these efforts are supported by appropriate policies and investments at all levels, from local to national.

REFERENCES

Béné, C., Delphine, D., Florence, D., Jérôme E. (2014). Resilience, Poverty and Development. *Journal of International Development*, 26(5), 598-623. https://doi.org/10.1002/jid.2992

Chanza, I. J. T., Andrew, W. N. (2016). Enhancing Community-Based Adaptation to Climate Change through Traditional Knowledge: Insights from Southern Africa. *Current Opinion in Environmental Sustainability*, 21, 18-23. https://doi.org/10.1016/j.cosust.2016.10.004

Diallo, R. (2023). Burkina /Tourisme: En attendant la fin des travaux, le Village opéra de Laongo fait déjà le bonheur des populations. [Pending completion of the works, the Village Opéra in Laongo is already bringing joy to the local population] *Le Faso.net*, https://lefaso.net/spip.php?article125051. (Last accessed May 13, 2024).

Gouvernorat du Plateau central (2023). Mise en œuvre du programme résilience: le Gouverneur salue la bravoure des populations bénéficiaires. [Implementation of the resilience programme: the governor praises the bravery of the beneficiaries] https://web.facebook.com/100064636004537/posts/pfbid0N5yMds7xhfqFVp5DFeQ9bQrWRe17edw8fTXvnhNxAn1XhDYEn4fTZhGJKHemJFzkl/?app=fbl&_rdc=1&_rdr. (Last accessed May 13, 2024).

Kaboré, D., Chris, R. (2004). The Emergence and Spreading of an Improved Traditional Soil and Water Conservation Practice in Burkina Faso. *Environment and Production Technology Division Discussion Paper, International Food Policy Research Institute.*

Lal, R. (2016). Food Security in a Changing Climate. *Ecohydrology & Hydrobiology*, 16, (2), 80-92.

Mbow, C., Richard, T. T. F. (2019). Agroforestry Solutions to Address Food Security and Climate Change Challenges in Africa. *Current Opinion in Environmental Sustainability*, 39, 80-85. https://doi.org/10.1016/j.cosust.2019.08.003

Mungai, C. A. O., Lilian, K. G. (2017). ICT for Weather Forecasting and Early Warning Systems in Africa. *Global Environmental Change*, 44, 123-134. https://doi.org/10.1016/j.gloenvcha.2017.04.003

Nyasimi, M., Anne, W. A. (2019). The Role of Women in Climate Change Adaptation: Case Studies from Africa. *Global Environmental Change*, 54, 147-156. https://doi.org/10.1016/j.gloenvcha.2018.10.006

Organisation des Nations unies pour l'alimentation et l'agriculture (FAO), 2019. Guide pratique pour l'agriculture durable et résiliente au changement climatique. [A practical guide to sustainable agriculture resilient to climate change] FAO.

Ouédraogo, S., Zougmoré, R., Paré, S. (2018). Pratiques agro-écologiques et adaptation aux changements climatiques au Burkina Faso. [Agro-ecological practices and adaptation to climate change in Burkina Faso] *Agriculture, Ecosystems & Environment*, 258, 236-247. https://doi.org/10.1016/j.agee.2018.02.015

Pretty, J., Zareen, P. B., Lawrence, H. (2018). Global Assessment of Agricultural System Redesign for Sustainable Intensification. *Nature Sustainability*, 1, 441-446. https://doi.org/10.1038/s41893-018-0114-0

Rockström, J., Louise, K., Johan, H., Steve, W. L. (2010). Managing Water in Rainfed Agriculture. *The Global Water System in the Anthropocene*, 315-333.

Satterthwaite, D., Cassidy, J., Alex, O. (2020). Building Resilience to Climate Change in Informal Settlements. *One Earth*, 2, 143-156. https://doi.org/10.1016/j.oneear.2020.02.002

Simon, D., Helen, P. (2019). Urban Climate Resilience: Planning and Governance Challenges in African Cities. *Global Environmental Change*, 55, 1-10. https://doi.org/10.1016/j.gloenvcha.2019.02.009

Taylor, A., Gina, Z. (2017). Building Resilient Urban Communities: Integrating Climate Adaptation in Urban Planning in Africa. *Global Environmental Change*, 46, 28-138. https://doi.org/10.1016/j.gloenvcha.2017.06.003

Tindyebwa, P. S. N., Paul, V. M. (2021). Policy Coherence and Regional Cooperation for Climate Adaptation in Africa. *Environmental Science & Policy*, 115, 26-35. https://doi.org/10.1016/j.envsci.2020.09.015

Yaméogo, A., Zongo, S., Ouédraogo, M. (2018). Transhumance et adaptation des éleveurs face aux changements climatiques au Burkina Faso. [Transhumance and adaptation of livestock farmers to climate change in Burkina Faso] *Pastoralism: Research, Policy and Practice*, 8, (1). https://doi.org/10.1186/s13570-018-0121-5

Zoma, V., Tarama, W. J. I. (2021). Perceptions et adaptation des populations de la commune de Seytenga au Burkina Faso face au changement climatique. [Perceptions and adaptation to climate change of Seytenga in Burkina Faso to climate change] *Revue Della/Afrique*, Numéro Spécial /Décembre. 121-136.

Zoma, V., Tarama, W. J. I. (2022). Planification locale et prise en compte de la variabilité climatique dans la commune rurale de Seytenga au Burkina Faso. [Local planning and taking climate variability into account in the rural commune of Seytenga in Burkina Faso] *Revue des Sciences Sociales-Programme d'Appui Stratégique à la Recherche Scientifique (RSS-PASRES)*, 9e année, (33), 106-118.

Zongo, S., Diallo, R., Ouédraogo Moussa, 2022. Utilisation de matériaux locaux pour la construction bioclimatique au Burkina Faso: une stratégie d'adaptation aux changements climatiques. [Use of local materials for bioclimatic bioclimatic construction in Burkina Faso: a strategy for adapting to climate change] *Building and Environment*, 205(108323). https://doi.org/10.1016/j.buildenv.2021.108323

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THE NEXUS BETWEEN TOURIST MOTIVATION AND SATISFACTION IN LEKKI URBAN FOREST AND ANIMAL SHELTER INITIATIVE (LUFASI) LAGOS STATE, (NIGERIA)

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ABSTRACT

Tourism refers to the act of individuals or groups spending time away from home for amusement, relaxation, and pleasure while utilizing commercial services. Meanwhile, the patronage of tourist destinations in Nigeria is influenced by various factors, including motivations and perceptions visitors had when they visit such destinations, which can impact customer patronage. This study was carried out in LUFASI in Lagos state, Nigeria. A total number of 359 respondents were selected using Yamane (1967) formula. A well-structured close-ended questionnaire was used for data collection, and the results were statistically analyzed using both descriptive and inferential statistics. This study revealed that the primary motivation for most respondents to engage in tourism was fun, with 49.9% of the respondents agreeing and 44.3% strongly agreeing. Additionally, 45.4% were satisfied and 44.0% of the respondents were very satisfied with the park. The visitors were motivated to visit the park for the following reasons: novelty, relaxation/escape, relationships, nature, and self-development. The study also found that the management of LUFASI Park is doing a commendable job in managing and protecting their natural environment by ensuring that the inflow of tourists and their activities does not affect the natural resources. Lufasi Park has an impressive environment that provides a high level of satisfaction for tourists from diverse backgrounds.

Keywords: *nature-based tourism, motivation, satisfaction, tourist inflow, perception*

INTRODUCTION

Tourism, historically linked to classical antiquity, refers to the movement of people from their usual environment to other places primarily for leisure, recreation, or business purposes while utilizing commercial services (Walton, 2021). Although the concept of travel for pleasure has ancient roots, modern tourism as a socio-economic phenomenon emerged in Western Europe in the 17th century. According to the World Tourism Organization (2010), tourists are individuals who travel and stay outside their usual environment for no more than a year, for purposes such as leisure, business, or other motives, and they can do so domestically or internationally. In recent times, tourism has become a significant contributor to the global economy, creating opportunities for socio-economic development, particularly in industrialized nations (Ajake & Amalu, 2012). It has also played

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a vital role in fostering cultural integration among people of diverse backgrounds within and across nations (Aniah, Eja, & Ushie, 2009). A tourist destination is defined not only by its geographical location but also by a combination of attractions, accessibility, amenities, and auxiliary services that distinguish it according to potential visitors (World Tourism Organization, 2010). Successful destinations are those that provide appealing and memorable experiences, thus securing competitive advantages in the tourism market (Dwyer & Kim, 2003). Tourism products encompass all services and experiences consumed by tourists during their visit, ranging from accommodation and transportation to attractions and activities. The decision to visit a particular destination is often influenced by factors such as ease of access, quality of accommodations, and the image projected by the destination (March & Woodside, 2005; Baloglu, 2001). Travelers are drawn to destinations by a combination of internal motivations—such as the desire for novelty, relaxation, and self-development—and external features like natural attractions, cultural heritage, and recreational activities (Lee et al., 2014). Motivation plays a crucial role in tourist behavior, shaping both the decision to travel and the choice of destination (Yolal et al., 2015). The push and pull theory of motivation, proposed by Jang et al. (2009), posits that individuals are driven to travel by internal push factors, such as the need for escape or personal growth, and external pull factors, such as the allure of a destination's attractions and amenities. Understanding the motivations of tourists is essential for destinations seeking to enhance their appeal and improve visitor satisfaction (O'Leary & Deegan, 2005). Satisfaction, on the other hand, is a critical measure of a destination's success and refers to the extent to which a tourist's experience meets or exceeds their expectations (Chen & Tsai, 2007). Tourist satisfaction is influenced by various factors, including the quality of customer service, the environment, and the overall experience provided by the destination (Eagles, 2002). High levels of satisfaction lead to positive word-of-mouth and repeat visits, contributing to the long-term sustainability of tourist destinations (Ninemeier & Perdue, 2008). This study aims to explore the relationship between tourist motivation and satisfaction at the Lekki Urban Forest and Animal Shelter Initiative (LUFASI), a nature-based tourism site in Lagos State, Nigeria. LUFASI provides a unique blend of conservation, recreation, and educational experiences, making it an ideal case for understanding how different motivational factors influence tourist satisfaction in a natural setting.

LITERATURE REVIEW

Concept of Motivation in Tourism

Motivation is central to understanding tourist behavior, as it explains the reasons behind individuals' travel decisions and activities at a destination. Derived from the Latin verb *movere*, meaning "to move," motivation can be described as the internal or external factors that propel individuals to engage in specific actions (Tran & Ralston, 2006). In tourism, motivation reflects the needs, desires, and goals that influence the decision to travel. According to Pearce (2013), psychological needs drive tourist behavior, coordinating and integrating actions that fulfill those needs. These motivations play a critical role in destination choice, shaping both the decision to travel and the specific activities undertaken (Yolal et al., 2015). Several studies categorize tourist motivations into psychological, socio-cultural, and environmental drivers. Psychological motivations involve personal fulfillment, novelty, and the desire to escape everyday life (Park & Yoon, 2009). Socio-cultural motivations include the desire to interact with different people and experience diverse cultures, while environmental factors often pertain to the natural beauty and scenery of a destination (Aniah et al., 2009).

Push and Pull Theory of Motivation

One of the most widely accepted frameworks for understanding tourist motivation is the push and pull theory. According to Jang et al. (2009), push factors refer to the internal or psychological desires that motivate individuals to travel, such as the need for relaxation, adventure, or self-development. These are intrinsic motivations that drive the initial decision to travel. On the other hand, pull factors relate to the external attributes of a destination that attract tourists, such as natural beauty, cultural heritage, or unique attractions (Jang & Cai, 2002). This theory suggests that successful destinations must cater to both the internal motivations of tourists and provide appealing external features (Pan & Ryan, 2007). For example, travelers may be pushed to seek relaxation and adventure while being pulled by the scenic beauty and recreational activities offered by a destination like LUFASI Park.

Tourism Motivation and Ecotourism

In the context of ecotourism, where nature and conservation are central, motivations often stem from a desire to engage with nature, learn about conservation efforts, and experience tranquility away from urban environments. Studies by Lee et al. (2014) highlight that ecotourists are often driven by a combination of relaxation and educational pursuits. Factors such as the opportunity to reconnect with nature, engage in environmentally responsible activities, and contribute to conservation efforts can significantly influence ecotourism motivations. Moreover, the element of novelty experiencing something different or unique—also plays a pivotal role in motivating tourists to visit nature-based attractions (Mak, 2015).

Concept of Satisfaction in Tourism

Tourist satisfaction is a key measure of a destination's success, referring to the fulfillment of tourists' expectations during their visit. Satisfaction is influenced by both the quality of services and the overall experience provided by the destination. According to Chen and Tsai (2007), tourist satisfaction is determined by how well a destination meets or exceeds the expectations tourists form before their visit. The degree of satisfaction influences whether a tourist will return to a destination or recommend it to others. In the tourism context, satisfaction is often linked to the perceived value of the experiences, which include factors like service quality, accessibility, and the destination's ability to provide the desired experience (Severt et al., 2007). High levels of satisfaction contribute to positive word-of-mouth and destination loyalty, while dissatisfaction can lead to negative perceptions that harm a destination's reputation.

Factors Affecting Tourist Satisfaction

Several factors influence tourist satisfaction, including destination accessibility, amenities, natural beauty, and customer service. Goeldner, Ritchie, and McIntosh (2000) argue that tourists evaluate a destination based on the quality of its transportation, accommodation, and attractions. Satisfaction is closely tied to the overall experience at a destination, and it can be impacted by both the tangible and intangible aspects of the visit. For instance, Baloglu (2001) notes that a destination's image, shaped by marketing and prior visitor experiences, plays a crucial role in forming tourist expectations and satisfaction. Eagles (2002) further emphasizes that tourist satisfaction in nature-based destinations is heavily influenced by the quality of the natural environment and the conservation practices in place. In such settings, tourists expect not only to enjoy the scenery, but also to see that the environment is being preserved and that their presence does not negatively impact the area. This is particularly important in destinations like LUFASI, where conservation and education are key elements of the tourist experience.

Ecotourism and Tourist Satisfaction

Ecotourism offers unique challenges and opportunities in terms of tourist satisfaction. Lee et al. (2014) identifies that ecotourism satisfaction is often driven by educational experiences, environmental conservation efforts, and opportunities for personal growth. Ecotourists generally seek more than just entertainment—they are keen to learn, engage with local cultures, and contribute to the sustainability of the environment. In this context, the satisfaction of ecotourists is closely tied to the perceived authenticity and sustainability of their experiences.

The Relationship between Motivation and Satisfaction

There is a strong relationship between tourist motivation and satisfaction. Tourists who are motivated by specific factors, such as the desire for relaxation, novelty, or educational experiences, are more likely to be satisfied if these needs are met during their visit (Chen & Chen, 2010). As a result, destinations must tailor their offer to match the motivation of their target market. For example, destinations that attract nature-loving tourists must ensure that their environmental practices align with the expectations of eco-conscious visitors. Ninemeier and Perdue (2008) highlight that understanding tourist motivation is essential for improving satisfaction levels, as motivated tourists are more likely to have their expectations met, leading to greater satisfaction. This in turn fosters repeat visits and positive reviews, which are crucial for the sustainability of tourist destinations.

Understanding tourist motivation and satisfaction is essential for the development and sustainability of tourist destinations. Theories such as the push and pull model provide valuable insights into why tourists choose specific destinations, while satisfaction research emphasizes the importance of meeting or exceeding tourist expectations. For nature-based destinations like LUFASI, catering to both the motivational factors (such as novelty, relaxation, and environmental consciousness) and ensuring high levels of satisfaction through quality services and environmental stewardship are critical for long-term success.

METHODOLOGY

Study Area

The Lekki Urban Forest and Animal Shelter Initiative (LUFASI), a specially chosen nature-based leisure area in Lagos State, Southwest Nigeria, served as the study's site. The location was picked due to its popularity and natural surroundings. On January 4, 2013, LUFASI was established. A conservation center and animal refuge, LUFASI Park is situated by the Lekki Epe highway. The park was established in 2013 as a non-governmental organization (NGO) with the exclusive mission of conserving the environment, safeguarding animals, and preserving endangered species in the Lagos metropolitan region. LUFASI Nature Park was founded by Desmond Majekodunmi. LUFASI Park serves as an animal sanctuary and forest conservation. It was officially launched in November 2016 (Adedoyin and Ajani, 2021).

To become acquainted with the research site, a preliminary assessment of the region was conducted. Tourists were given standardized questionnaires to complete, providing data for the study.

Sample Procedure and Sample size

The target population for this study consisted of tourists who visited the Lekki Urban Forest and Animal Shelter Initiative (LUFASI) in Lagos, Nigeria. To determine the appropriate sample size, the Yamane (1967) formu-

la was applied, which is widely used in social sciences for sampling large populations. The formula is as follows:

$$n = \frac{N}{1 + Ne^2}$$

$$n = \frac{3536}{1 + 3536x(0.05)^2}$$

- where: n = Sample size, N= target population, e= percentage of error = 5%, 1= constant value

LUFASI's management provided the data on the total number of tourists who visited the park between 2018 and 2021, which amounted to 3,536 visitors. Using this population figure and applying a 5% margin of error, the calculated sample size was 359 respondents. This sample size was deemed adequate to provide statistically significant results while maintaining a manageable and practical number of respondents for data collection. The study adopted a **systematic sampling technique** to select participants. First, tourists visiting the park during the survey period were identified, and only those aged 18 years and older were considered. From this target population, respondents were systematically selected at regular intervals to ensure a representative sample. This approach ensured that every visitor had an equal chance of being selected, thereby reducing selection bias.

To ensure a comprehensive representation of tourist experiences, the questionnaire was distributed to a diverse group of visitors, including both first-time and repeat tourists, as well as domestic and international visitors. The data collection process spanned multiple days to account for variations in visitor patterns and to include tourists with different visit motivations and experiences. By adhering to this sample procedure and using a systematic method, the study accurately aimed to capture the motivations, experiences, and satisfaction levels of tourists visiting LUFASI.

RESULTS AND DISCUSSION

Motivating factors for the tourists

It is expected that specific factors or indices must have motivated individual(s) to travel to a destination for tourism. The table 1 shows a breakdown of the indicators of these four (4) broad elements (novelty, relaxation/escape, nature, and self-development) and their respective statistical computations.

The results reveal that most of the respondents noted that the desire to have fun is a tourism motivation, as 49.9% of the respondents agreed to having fun and 44.3% strongly agreed that having fun is motivating. Most of the respondents noted that their desires to experience something different are a tourism motivation, as 46.8% agreed to experiencing something different while 44.6% strongly agreed to experiencing something different. Similarly, the desire to visit a place of personal interest can serve as tourism motivation, as more than 90% of the participants strongly agreed with or agreed to visiting places related to their personal interests. Mak (2015) noted that the characteristics that drive people to seek novelty reflect a person's choice of novel experiences, as well as general personality traits with stability and consistency. Aydin et al. (2022) pointed out that familiarity with a tourist location, especially in terms of personal interest, is a key condition for tourism enthusiasts seeking novelty. Lee and Compton (2022) noted that the typical description of novelty centers around the fact that individuals may travel because of their desire to experience something new or different. The novelty associated with a tourist attraction can get people enthusiastic about visiting such a tourist attraction. Blomstervik and Olsen (2022) argued that the dynamics that trigger, activate, influence, or motivate novelty via antecedent relate to novelty-specific personal traits, which are characterized by the arous-

al, sensation -seeking, a desire for variety, and optimized conditions. Chen and Yoon (2019) noted that those that seek novelty usually tend to have greater satisfaction with their lives. According to Drewery et al. (2016), novelty attractions impact individuals who lead a satisfying lifestyle, and seek unique and diverse activities. Basically, the novelty of a tourist destination, which highlights the rarity and authenticity of the destination, should be a fundamental reason for visiting such tourism attractions. Supaporn (2018) noted that novelty, as well as search for leisure, were relevant travel motivators that the TCP model emphasizes as main motivators.

Table 1. The tourist motivating factors

	Disagree	Strongly Disagree	Agree	Strongly Agree	Mean	Std. Deviation
Novelty						
Having Fun	3.3	2.5	49.9	44.3	3.3510	.69269
Experiencing Something Different	6.7	1.9	46.8	44.6	3.2925	.80551
Visiting Places Related to My Personal Interest	5.6	4.2	52.4	37.9	3.3064	1.74994
Relax/Escape						
Resting and Relaxing	4.2	1.4	51.8	42.6	3.3287	.70753
Being Away from Daily Routine	3.6	2.8	47.9	45.7	3.3565	.70979
Giving My Mind at Rest	3.3	3.1	49.6	44.0	3.3426	.69888
Getting Away from Everyday Physical Stress/ Pressure	4.5	5.0	47.9	42.6	3.2869	.75755
Getting Away from Everyday Psychological Stress/Pressure	7.5	3.1	44.3	45.1	3.2702	.84363
Nature						
Viewing the Scenery	4.5	2.2	44.8	48.5	3.3733	.73989
Being Close to Nature	4.5	1.9	48.2	45.4	3.3454	.73075
Getting a Better Appreciation with Nature	5.6	3.1	45.1	46.2	3.3203	.78420
Being Harmonious with Nature	6.1	2.8	49.6	41.5	3.2646	.78722
Self-Development (Personal/Host Community)						
Learning New Things	5.3	0.6	41.5	52.6	3.4150	.75701
Meeting New Varied People	4.7	1.7	49.3	44.3	3.3315	.73529
Developing my Knowledge	3.3	1.7	48.2	46.8	3.3844	.68698
Observing the Environment	3.1	2.5	47.6	46.8	3.3816	.68650
Developing my Personal Interest	3.3	2.8	48.2	45.7	3.3621	.69901
Gaining A Sense of Accomplishment	7.2	3.3	51.5	37.9	3.2006	.81460

Source: Field survey (2022)

It is also evident from the result that most respondents identified rest and relaxation as motivating factors for tourism. This is supported by the fact that 51.8% agreed and 42.6% strongly agreed that resting and relaxing motivated them. Likewise, most respondents noted that disengagement from daily routine can motivate an individual to travel, as more than 90% of the respondents either agreed or strongly agreed that being away from daily routine can motivate tourism. The idea that an individual's mind can be at rest, at least from the hustle of the city and work, also motivates people to travel, as reflected in the responses: 49.6% agreed and 44.0% strongly agreed to giving their mind rest while traveling. Tourism, which usually takes place outside

an individual's residence, provides an opportunity to escape regular day-to-day pressures and stress. In fact, 47.9% agreed and 42.6% strongly agreed on staying away from daily physical stress and pressure. Similarly, tourism allows people to escape from daily psychological stress and pressure, with 44.3% agreeing and 45.1% strongly agreeing. Vuuren and Slabbert (2011) noted that tourists usually escape and relax to relieve both physical and mental pressure. There is also an indication that the main motivator for tourists revolves around rest and relaxation. Said and Maryono (2018) noted that relaxation, as a tourism motivating factor, involves disengaging from routine activities for enjoyment and romance. Escape entails the creation of changes or stepping away from regular everyday engagements, as well as the release of stress.

The potential view of beautiful scenery at a tourist destination could motivate people to travel with 44.8% of the respondents agreeing and 48.5% strongly agreeing to viewing beautiful scenery. People who love natural ambience will be motivated to go to tourist destinations where they will be closer to nature - 48.2% of the respondents agreed and 45.4% of the respondents strongly agreed to being close to nature. Closeness to nature apparently culminates in better appreciation of nature; this is because 45.1% of the respondents agreed and 46.2% strongly agreed to getting a better appreciation of nature. Likewise, it makes it easier for some tourists to harmoniously co-exist with nature; 49.6% agreed and 41.5% strongly agreed to being harmonious with nature. Said and Maryono (2018) noted that natural environments with diverse attributes and characteristics can motivate people to visit such environments. A tourist who left the hustle and bustle of the city would prefer to go to a less noisy and more serene environment for vacation. Devesa et al. (2009) highlighted defining personal traits of rural tourists, who seek tranquility as well as connection with nature and those connected with culture-bound visits. Ramazannejad et al. (2022) noted that inclusive of nature-based attributes, conditions like spiritual regeneration, feeling of belonging, buying farm produce, as well as culture matters, are highly significant motivating factors for travelling. Agyeiwaah et al. (2013) stated that for the contemporary study, preserving the environment appears to motivate choosing a homestay, although foreign visitors do not emphasize it.

Education is a significant motivator for tourism because, in most cases, tourists learn new things or ideas at tourist destinations - 41.5% agreed and 52.6% strongly agreed that learning new things on tour can motivate them to travel. Meeting new people while travelling may be a motivator, as 49.3% agreed and 44.3% strongly agreed with the statement. The educational aspects of tourism deepen the knowledge of people with 48.2% of the respondents agreeing, and 46.8% strongly agreeing. Observation of the environment is also a strong tourism motivator with 47.6% agreeing and 46.8% strongly agreeing. The presence of the tourist at a destination may make the tourist develop personal interest for specific tourism elements - 48.2% agreed to developing their personal interest, and 45.7% strongly agreed to developing their personal interest. Overall, the notion that a prospective tourist will have a sense of accomplishment after leaving a tourist destination may motivate such a tourist to travel - 51.5% agreed and 37.9% strongly agreed to gaining a sense of accomplishment after departing from the tourist destination. Mannell and Iso-Ahola (1987) established a four-dimensional motivational theory: personal seeking, personal escape, interpersonal seeking, as well as interpersonal escape. Education is certainly part of tourism because a tourist is bound to learn more while traveling, and individuals travel to disengage from their challenges to obtain personal or interpersonal gains (Prosperous and Lakavath, 2019).

Tourist Satisfaction

Lufasi Park is easy to locate for tourists because 45.4% were satisfied and 44.0% of the respondents were very satisfied with finding the park. The park has its parking lot, and people could also park close to the park. 58.8% of the respondents were satisfied, and 29.2% were very satisfied with parking close to the park. Tourists find the opening hours of the park satisfactory; 53.2% of the respondents were satisfied, and 37.0% were very satisfied with the opening hours of the park. Overall, the accessibility of the park is satisfactory; 52.6% of the respondents were satisfied, and 35.7% were very satisfied with the overall assessment of the park's accessibility. Past research has shown that an accessible destination has the tendency of attracting more tour-

ists, which can consequently result in enhanced tourism activities and tourist satisfaction (Guiver and Stanford, 2014; Ramyar and Halim, 2020). Lufasi Park is indeed accessible because of how easy it was for tourists to locate the parking facilities. Dumitrascu et al. (2023) noted that a typical attraction that offers an impressive degree of visitor's satisfaction has the tendency of being less affected by accessibility challenges. Rajesh (2013) noted that accessibility is an attribute of the image of a tourist location that impacts the satisfaction of tourists. Castro et al. (2017) suggested that accessibility to a tourist destination is significant in measuring visitors' satisfaction.

Table 2. Tourist Satisfaction with site accessibility

	N	Very dissatisfied	Not very satisfied	Satisfied	Very satisfied	Mean	Std. Deviation
Ease in finding the park	359	2.5	8.1	45.4	44.0	3.3092	.72597
Ease in parking close by	359	2.2	9.7	58.8	29.2	3.1504	.67658
Opening hours	359	2.2	7.5	53.2	37.0	3.2507	.68796
Overall assessment of the park's accessibility	359	3.3	8.4	52.6	35.7	3.2061	.72994

Source: Field survey (2022)

Satisfaction of tourists with LUFASI Premises

Tourists at the park generally expressed satisfaction with the surroundings of the park; 45.1% were satisfied and 48.5% were very satisfied with the surroundings of the park. Based on their satisfaction with the surroundings of the park, they also expressed satisfaction with the comfort that comes from the park's surroundings; 55.2% of the respondents were satisfied, and 39.6% of the respondents were very satisfied with the comfort of the premises. Tourists also expressed satisfaction with self-service and tourism information at their disposal; 50.4% were satisfied and 40.4% were very satisfied with the self-service and tourist information. Overall, the tourists expressed general satisfaction with their assessment of the park. 48.7% were satisfied and 40.4% were very satisfied with the overall assessment of the park's premises. As expected of a park, Lufasi has a serene, neat, and clean environment. This indicates that the park management is conscious of the principles of park management, and they regularly administer these principles at Lufasi. Lascu et al. (2018) identified amenities as a predictor of destination image that significantly influences tourist satisfaction. Sitari et al. (2019) submitted that the major indicators influencing tourist satisfaction include physical indicators, relevant for nature tourism.

Table 3. Tourist Satisfaction with site premises

	Very dissatisfied (%)	Not very satisfied (%)	Satisfied (%)	Very satisfied (%)	Mean	Std. Deviation
Surroundings (neatness, temperature, arrangement of the animal cage etc.)	1.7	4.7	45.1	48.5	3.4039	.66104
Comfort of the premises	1.4	3.9	55.2	39.6	3.3287	.61910
Self-service and tourist information	3.6	5.6	50.4	40.4	3.2758	.72793
Overall assessment of the park premises	3.3	7.5	48.7	40.4	3.2618	.73877
Valid N (listwise)						

Source: Field survey (2022)

Tourist Satisfaction with the LUFASI Staff

The waiting time for tourists to get responses from the staff members of LUFASI was not dominant, as 52.1% of the respondents were satisfied and 31.8% were very satisfied with the waiting time. Similarly, the staff members exhibited appropriate courtesy when communicating with tourists, as 58.0% of the respondents were satisfied and 31.8% were very satisfied with that. The staff members of the park listened attentively to the questions and requests of the tourists because 51.3% of the respondents were satisfied and 39.9% were very satisfied. Invariably, the staff members of the park made themselves available to the tourists, as 55.4% of the respondents were satisfied with the staff members' availability and 37.0% were very satisfied. The fact that the staff members were available and listened to the tourists made it easy for them to understand tourists' requests. 49.9% of the respondents were satisfied with how the staff members understood their requests, and 39.9% were very satisfied. The responses of the staff members generally met the request of the tourist because 50.7% of the respondents were satisfied and 37.6% were very satisfied because the staff reply suited their request. The tourists also largely got prompt responses to their requests because 50.7% of the staff members were satisfied and 39.1% were very satisfied because the tourists got prompt answers to their requests.

Table 4. Tourist Satisfaction with staff attitude and competence

Assessment Statement	Very dissatisfied (%)	Not very satisfied (%)	Satisfied (%)	Very satisfied (%)	Mean (%)	Std. Deviation (%)
Waiting time	1.9	9.7	52.1	31.8	3.2770	1.75277
Courtesy of your interlocutor	3.5	6.7	58.0	31.8	3.1808	.70253
Listening	1.2	7.6	51.3	39.9	3.3003	.65799
Availability	1.5	6.1	55.4	37.0	3.2799	.64239
Understanding your request	1.5	8.7	49.9	39.9	3.2828	.68306
Response to your request	2.9	8.7	50.7	37.6	3.2303	.72710
Quickness to respond	2.6	7.6	50.7	39.1	3.2624	.70996
Overall assessment of the park's staff	1.7	8.7	55.1	34.4	3.2216	.67356

Tanković et al. (2023) suggests that the results of contemporary research show that communication capacities have positive effects on other forms of soft skills that finally lead to enhanced clients' satisfaction. King (2004) believes that adverse behavior of staff members has damaged different organizations as well as made many organizations lose millions of dollars daily. Company staff members are significant to ensure good clients' perception as well as satisfaction because these staff members generally have the responsibilities of making available qualitative services that meet clients' expectations (Zeithaml et al., 1996). Research findings have shown that the positive or negative behavioral habits of staff members have a significant correlation to clients' general satisfaction (Kattara et al., 2015). Perić et al. (2018) noted that the contact between staff members and visitors is a fundamental indicator of the degree of visitor's satisfaction, and it also determines service quality. Perić et al. (2018) noted that, based on research findings, ethical and friendly communication are the conditions that visitors consider to be highly positive and crucial. The courtesy of staff members, being professional and hospitable, correlates with visitors' overall satisfaction. For businesses that are highly competitive, staff members' attitudes are key to determine and attain efficiencies, effectiveness, as well as clients' happiness in an organization (Kwizera et al., 2019). Wampande and Osunsan (2020) claim that the attitudes of staff members of hotels have a substantial impact on the satisfaction of customers. It is notable that when employees appreciate tourist satisfaction and see the clear link to the services they provided, such employees may be motivated to perform better subsequently. Olawuyi (2017) explains that employees' performance can easily get enhanced because of being motivated by clients.

CONCLUSION

A prospective tourist must have been enthused or motivated by certain things or conditions before such an individual will travel out of their place of residence to a tourist destination. It is notable that the attractions at the tourist destination are essential motivators for tourism motivation. However, tourism motivation can be psychologically or emotionally underpinned. Briefly, the highest predictors for each of the tourists' motivators considered for this study are as follows: a visit to a place of personal interest is the biggest predictor of novelty; an escape from everyday psychological stress/pressure is the highest predictor of relaxation/escape; being harmonious with nature is the highest predictor of nature; and gaining a sense of accomplishment is the highest predictor of self-development. Accessibility to a tourist destination is paramount to determining the success of such a destination. If a tourist destination is inaccessible, then it may not attract the right type of tourist and the right number of tourists. This study revealed the predictors that led to the highest level of tourists' satisfaction are as follows: tourists' general assessment of the park's accessibility, their general assessment of the park's premises and their waiting time at the park. Finally, Lufasi Park has met the expectations of tourists. The park is remarkably accessible, with good parking lots for tourists. Lufasi Park has an impressive environment that can give tourists from different backgrounds a sufficient level of satisfaction. It is important that the employees of Lufasi Park are prompt in responding to the needs and requests of the tourists. It is evident that most tourists were at Lufasi Park because it was related to their personal interests, and these tourists were satisfied with the impressively short waiting time they experienced at the park.

REFERENCES

Agyeiwaah, E., Akyeampong, O., Amenumey, E. (2013). International tourists' motivations to choose homestay: Do their socio-demographics have any influence? *Tourism and Hospitality Research,* 13(1), 16–26.

Ajake, A. O., Amalu, T. E. (2012). Participation of Becheeve people in tourism development in Obudu Mountain Resort Cross River State Nigeria. *British Journal of Humanities and Social Sciences,* 3(2), 25-39.

Adedoyin, A. H., Ajani, F. (2021). Management effectiveness and tourist satisfaction in private protected areas. *Journal of Hospitality and Tourism Studies,* 2(2), 119-134.

Aniah, E. J., Eja, E. I., Otu, J. E., Ushie, M. A. (2009). Patronage of ecotourism potentials as a strategy for sustainable tourism development in Cross River State Nigeria. *Journal of Geography and Geology,* 1(2), 20-27.

Aydin, B., Erdogan, B., Koc, E. (2022). The impact of novelty seeking on intention to visit a country: The mediating role of overall cuisine image. *An International Journal of Akdeniz University Tourism Faculty,* 10(3), 480-500.

Baloglu, S., Mangaloglu, M. (2001). Tourist destination images of Turkey, Egypt, Greece, and Italy as perceived by US-based tour operators and travel agents. *Tourism Management,* 22(1), 1-9.

Blomstervik, I., Olsen, S. (2022). Progress on novelty in tourism: An integration of personality, attitudinal, and emotional theoretical foundations. *Tourism Management,* 93, 104744. https://doi.org/10.1016/j.tourman.2022.104744

Castro, J., Quisimalin, M., Pablos, C., De Gancino, V., Jerez, J. (2017). Tourism marketing: Measuring tourist satisfaction. *Journal of Service Science and Management,* 10(3), 280–308. https://doi.org/10.4236/jssm.2017.103023

Chen, C., Yoon, S. (2019). Tourism as a pathway to the good life: Comparing the top–down and bottom-up effects. *Journal of Travel Research,* 58(5), 866–876. https://doi.org/10.1177/0047287518775282

Devesa, M., Laguna, M., Palacios, A. (2009). The role of motivation in visitor satisfaction: Empirical evidence in rural tourism. *Tourism Management,* 31, 547–552. https://doi.org/10.1016/j.tourman.2009.06.006

Drewery, D., Jiang, K., Hilbrecht, M., Mitas, O., Jakubowitz, A. (2016). Modelling activity novelty and adolescent females' subjective well-being during a winter holiday. *World Leisure Journal,* 58(4), 298–310. https://doi.org/10.1080/16078055.2016.1228218

Dumitrascu, A., Teodorescu, C., Cioclu, A. (2023). Accessibility and tourist satisfaction - Influencing factors for tourism in Dobrogea Romania. *Sustainability*, 15, 7525. https://doi.org/10.3390/su15097525

Dwyer, L., Kim, C. (2003). Destination competitiveness: Determinants and indicators. *Current Issues in Tourism*, 6(5), 369-414.

Eagles, P. F. J. (2002). Trends in park tourism: Economics, finance, and management. *Journal of Sustainable Tourism*, 10(2), 132–153.

Guiver, J., Stanford, D. (2014). Why destination visitor travel planning falls between the cracks. *Journal of Destination Marketing & Management*, 3, 140–151.

Jang, S., Cai, L. (2002). Travel motivations and destination choice: A study of British outbound market. *Journal of Travel and Tourism Marketing*, 13(3), 45-57.

Kattara, H., Weheba, D., Ahmed, O. (2015). The impact of employees' behavior on customers' service quality perceptions and overall satisfaction. *African Journal of Hospitality Tourism and Leisure*, 4(2), 1-14.

Lee, S., Lee, S., Lee, G. (2014). Ecotourists' motivation and revisit intention: A case study of restored ecological parks in South Korea. *Asia Pacific Journal of Tourism Research*, 19(11), 1327-1344. https://doi.org/10.1080/10941665.2013.852117

Mak, A. (2015). Novelty tourism. In: J. Jafari & H. Xiao (Eds.), *Encyclopedia of Tourism*. https://doi.org/10.1007/978-3-319-01669-6_460-1

Rajesh, R. (2013). Impact of tourist perceptions, destination image and tourist satisfaction on destination loyalty: A conceptual model. PASOS. *Revista de Turismo y Patrimonio Cultural*, 11(3), 67–78.

Said, J., Maryono, M. (2018). Motivation and perception of tourists as push and pull factors to visit national park. *E3S Web of Conferences, 31, 08022, 1-5. https://doi.org/10.1051/e3sconf/20183108022

Tanković, A., Vitezić, V., Kraljić, V. (2023). Employee communication and soft skills influencing tourists' satisfaction. *European Journal of Tourism Research*, 34, 3410. https://doi.org/10.54055/ejtr.v34i.2967

Walton, J. K. (2021). *Tourism*. Encyclopedia Britannica. https://www.britannica.com/topic/tourism

World Trade Organisation (WTO). (2010). *Tourism and poverty alleviation: Recommendation for action*. Madrid: World Trade Organisation.

Yamane, T. (1967). *Statistics: An introductory analysis (2nd ed.)*. New York: Harper and Row.

Zeithaml, V., Berry, L., Parasuraman, A. (1996). The behavioral consequences of service quality. *Journal of Marketing*, 60(2), 3.

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BEYOND MUSIC: THE SOCIALLY RESPONSIBLE LEGACY OF THE EXIT FOUNDATION – A RETROSPECTIVE STUDY

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ABSTRACT

Corporate social responsibility (CSR) is a term used to describe strategies companies apply to make them more ethical and friendly towards the community. The subject whose CSR activities proved to be of special interest, because of the scope of their influence, is the EXIT Foundation, the official organizer of the famous EXIT Festival, which has been held at the Petrovaradin Fortress in Novi Sad, Serbia since 2000. On the tenth anniversary of the founding of the EXIT Foundation, it was decided to conduct a retrospective analysis of the socially responsible activities conducted by this foundation. This analysis aimed to determine what types of CSR activities were conducted by the Foundation to pinpoint the main field of action, what fields were neglected, and to whom further attention should be given in the future. The multidimensional approach of implemented socially responsible initiatives made it impossible to identify a key field that could potentially be considered the focus of the CRS activities of the EXIT Foundation. However, based on the impact achieved by the festival itself, the need to focus future initiatives on the dimension of environmental protection was identified.

Keywords: *EXIT Festival, EXIT Foundation, corporate social responsibility*

INTRODUCTION

Festivals represent symbols of a country's culture reflecting the lifestyle, cultural standards, importance of culture, the fine boundaries between different art forms, as well as the need for togetherness and shared experiences (Hunyadi, 2004). These events can significantly influence all aspects of economic, cultural, and social life, bringing about both positive and negative effects. Some of the most harmful negative effects include changes in culture and the way of living of the local community, increased crime rates (Tsundoda & Mendlinger, 2009), inflation, crowding and congestion (Shelton, 2017), spatial and noise pollution, loss of value, destruction of historical resources and cultural heritage (Prodanović-Stamenović, 2015).

To combat these negative effects, the concept of corporate social responsibility (CSR) was created. CSR implies that companies and other legal entities consider the interests of the community by accepting responsibility for the impact of their conduct on customers, suppliers, workers, members of the community, and other relevant stakeholders in their environment. CSR refers to the strategies that companies apply, which impact their business in a way that makes them more ethical and friendly towards the community (Ismail, 2009).

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The festival whose CSR activities proved to be of special interest to the public, because of the scope of their influence, is the EXIT Festival, held at the Petrovaradin Fortress in Novi Sad, Serbia. Established in 2000 through a student movement with the goal of introducing democratic reforms in Serbia, this festival advocates for peace, democracy, multiculturalism, and human rights. These principles have evolved into integral components of its identity (Pivac et al., 2019), shaped over time through a distinctive electronic music lineup, various socially responsible initiatives, and robust support for humanitarian, environmental, and cultural causes and organizations. Due to its exceptionality, the EXIT Festival was declared the best European festival at the British Festival Awards in 2007, and it won the title of "Best European Festival" in 2013 and 2017 at the European Festival Awards (Internet 1).

The EXIT Foundation, which represents an integral component of the EXIT Festival team dedicated to social activism, was established in 2013. Its mission is to catalyze positive social transformation by utilising creative industries and organising events encompassing art, education, and humanitarian efforts. Through its endeavors, the Foundation played a pivotal role in Novi Sad being honored with the distinction of European Capital of Culture for 2022 and the prestigious title of Youth Capital of Europe in 2019 (Internet 2).

On the tenth anniversary of the EXIT Foundation, it was decided to conduct a retrospective analysis of the socially responsible activities conducted by this foundation. This analysis aimed to determine what types of CSR initiatives were conducted by the Foundation, to pinpoint what was the main field of action, what fields were neglected, and to whom further attention should be given in the future.

LITERATURE REVIEW

Throughout history, communities from different regions around the world have faced specific and difficult challenges. In those moments of need, human awareness and empathy came to light as communities worked together not only to create solutions for their problems, but also to help others in need. According to Angela (2006), foundations were initially created to support charitable, social, cultural, and scientific activities. Foundations, as we know them today, were established around the world to support charitable organizations and help solve problems. These organizations have had a positive effect on the global community by fostering international cooperation, understanding, and appreciation of other cultures and religions (Internet 3).

Corporate social responsibility (CSR) refers to the accountability of an organization or another legal entity for the impact of their decisions and actions on both society and the environment. This involves introducing transparent and ethical practices that align with the principles of sustainable development and contribute to the well-being of society. CSR considers the expectations of stakeholders, it is consistent with the law and international norms of behavior, and implemented throughout the organization (Slob & Oonk, 2007; Gorski et al. 2014). CSR activities in a country are shaped by its cultural values, economic and political systems, as well as the achieved level of development, and therefore it is necessary to adapt them and the related messages to the target market (Matten & Moon, 2008; Noga & Le Viet-Błaszczyk 2023).

The correlation between CSR and foundations is evident in their mutual commitment to nurturing positive change (Someshwari and Laxmana, 2020). To achieve the intended objectives, collaboration with various stakeholders is achieved through diverse activities and initiatives. This collaborative effort results in benefits for all parties involved (Greenwood, 2007; Goodman et al., 2017).

Gorski et al. (2014) underlined in their research the importance of striking a balance between economic, social, and ecological objectives to establish sustainability. This involves maximizing present well-being without compromising the ability of future generations to meet their needs. Consequently, CSR has gained significance for organizations as their key stakeholders now expect them to address not only economic concerns but also environmental and social issues relevant to the stakeholders. Over the past few decades, governments in numerous countries have shown increasing political interest in philanthropic foundations, aiming to foster partnership relations by integrating foundations into state administration (Anheier, 2018; Phillips,

2018; Toepler, 2017; Levy et al., 2023). This underscores the pivotal role of governments as crucial stakeholders for organizations, including foundations, emphasizing the necessity of collaborative endeavors for achieving enduring global sustainability.

Field of Education

Through their philanthropic initiatives, foundations impact educational policy and school reform. By offering grants to colleges and universities, community-based or national nonprofits, membership organizations, or associations of colleagues and universities (Rockefeller Philanthropy Advisors & TIAA Institute, 2019) they influence policy domains, levels of government involvement, and tactics for mobilizing additional resources and thus shape the education system (Sessions et al., 2016). The benefits of a foundation's investment in education extend beyond immediate academic gains. Improved academic performance is one outcome, followed by cultivating non-academic skills that contribute to holistic growth and development among students (Wood & Lithauer, 2006). In their endeavors, foundations try to provide easier access and success for low-income, first-generation students, contribute to career readiness, provide faculty support, and influence policy, advocacy, and system change, with larger foundations being more likely to support policy and systemic change across the entire field of higher education (Rockefeller Philanthropy Advisors & TIAA Institute, 2019). In cooperation with NIS Company from 2013 until 2019 the EXIT Foundation conducted the "Youth Heroes" campaign that aimed to promote positive examples to the youth of Serbia, ceremonially awarding the best achievers in the fields of education and science, entrepreneurship and creative industries, social activism, culture, and art (Internet 4).

Field of Economy

Investing in the economy provides numerous benefits for foundations, such as challenging traditional assumptions about economic development strategies and enhancing the well-being of numerous individuals (Heslop et al., 2019). This aligns with the principles of CSR, where foundations actively contribute to societal welfare through their economic pursuits. Furthermore, foundation-owned enterprises perform comparably to investor-owned counterparts, boasting similar accounting profitability, reduced risk, and steady growth (Thomsen & Hansmann, 2013). Additionally, foundations can leverage program investments to generate positive social impacts while expanding their assets (Rosener, 2013). Notably, investments in nonprofit activities can yield substantial social and economic returns, for example, each dollar invested in grants and support is estimated to generate $8.58 in economic benefits (Shapiro & Mathur, 2008). This underscores how foundation activities contribute not only to their expansion but also to societal well-being. In 2014, the EXIT Foundation conducted the BE HUMAN events, which raised over 140,000 euros during a two-night exclusive party and donor dinner to assist those affected by unprecedented floods (Internet 5).

Field of Environment

Environmental projects not only drive sustainable profitability but also improve the image of companies and foundations (Little, 1995). These efforts exemplify responsible corporate citizenship and demonstrate how foundations can use their financial influence to drive positive environmental change, aligning with corporate social responsibility principles that encourage businesses and foundations to contribute to the greater good. Furthermore, environmental projects foster the trust of external stakeholders and provide a competitive advantage for international expansion (Marco-Fondevila et al., 2018). In 2020, the EXIT Foundation launched the Conscious R:evolution platform which brought together leading global speakers, artists, scien-

tists, entrepreneurs, and activists to discuss the possible directions of collective and individual development of humanity, to achieve an entirely different way of looking at the planet and life (Internet 6).

Field of Health and Safety

Foundations play a crucial role in investing significantly in health and safety by fostering a safety-oriented culture within health institutions, supporting research endeavors aimed at enhancing patient safety and improving the efficiency of healthcare systems. This dedication to health and safety aligns with the foundational principles centered on fostering positive social impact (Vincent & Amalberti, 2016; Sessions et al., 2016). Moreover, foundations actively addressing environmental hazards, such as air and water pollution to mitigate these risks, and minimize potential harm to individuals and communities, underscoring their broader commitment to enhancing public welfare (Galt & Paschal, 2009). By integrating high-reliability principles into healthcare processes, foundations initiate cultural shifts that prioritize safety and quality outcomes. This contributes to improved healthcare operations and actively promotes a safer environment for both patients and healthcare professionals. Such initiatives demonstrate the foundations' dedication to positive social change (Oster & Deakins, 2018). Furthermore, foundations are extending their efforts to modernize public health infrastructure, a pivotal step in safeguarding national health and ensuring its security. Their commitment to advancing public health resonates with their broader philanthropic goals and underscores their initiative-taking role as contributors to social welfare (Green, 2004). In 2019, the EXIT Foundation, in collaboration with the Ministry of Health of the Republic of Serbia and Telekom Serbia, initiated a large national campaign "#Stayclean", which aimed to promote a clean life, without the use of drugs (Internet 7).

Field of Social and Cultural Development

Investing in social and cultural issues can positively impact people and communities, as foundations leverage their financial, human, and social capital to achieve tangible results (Zolfaghari & Hand 2021). Such investments additionally show a foundation's commitment to sustainable and holistic development, a basic tenet of the philosophy of socially responsible business practices. As foundations use their resources to make a positive impact, they exemplify a commitment to building a better society for the current and future generations. In 2017, responding to growing national tensions in the region, the EXIT Foundation launched the "Silent Balkans Majority". In an open letter, prominent artists and public figures from Serbia, Croatia, and Bosnia and Herzegovina urged the public to openly oppose extreme national rhetoric and promote peace in the region (Internet 8).

Field of Infrastructure

Investments in basic infrastructure affect the local community. Studies have indicated that such investments can help strengthen rural economies, promote economic growth and social development (Pavel et al., 2018). In addition to increasing local incomes, they also positively affect neighboring regions (Montolio, 2018). Additionally, infrastructure investment policies implemented at the local level can lead to temporary reductions in unemployment and significant declines in crime rates (Gnade et al., 2017). In 2018, in collaboration with NIS Company and the City of Novi Sad, the EXIT Foundation renovated the building "Mala Stražara" at the Petrovaradin Fortress, which is used by the Astronomical Society of Novi Sad as an observatory. This building, which dates from the 18th century, represents an important cultural heritage, whose renewal enriched the offer of the entire Petrovaradin Fortress complex (Internet 9).

MATERIALS AND METHODS

The methods used in this study include the analytical method (comparative analysis), the descriptive method, and the synthesis of induction and deduction. Comparative analysis involves comparing the similarities and differences between two or more researched problems or phenomena to identify the rules governing their interrelations (Peličić et al., 2015). The descriptive method focuses on the description of processes and phenomena (Vuković & Štrbac, 2019). Deduction represents a path of scientific knowledge that starts from a generally accepted premise to draw conclusions for individual and specific cases. Induction represents the reverse path of cognition starting from the collected data based to derive conclusion is drawn (Peličić et al., 2015).

To conduct a retrospective review of the socially responsible activities conducted by the EXIT Foundation from 2013 to 2023, an on-site survey was conducted. Data on the initiatives were extracted from the "Projects" section on the official EXIT Foundation website, which listed all the projects undertaken by the Foundation since its inception. It is important to note that only publicly accessible data sources were used in the analysis.

The initiatives were grouped based on the duration, the types of stakeholders involved, and the fields they addressed. Based on their legal status, stakeholders were divided into five groups: enterprises, government institutions, media outlets, the non-governmental sector, and foundations. Although media outlets fall under the category of enterprises, they were analyzed separately to understand the scope of media coverage of the initiatives. The fields covered by the initiatives were segmented into 6 fields - education, economy, environment, health and safety, social and cultural development, and infrastructural development – following the dimensions proposed by authors Panthong and Taecharungroj (2021) in the paper "Which CSR activities are preferred by residents from the local community? Combined and cluster analysis". This categorization was used because it was perceived as the most suitable for research objectives. Finally, the collected data was processed using Excel.

RESULTS

Under the "Projects" section on the official EXIT Foundation website, 31 initiatives conducted between 2013 and 2023 were identified. During the period from 2013-2017, which represents the first five years of the foundation's operation, 41.93% of initiatives were realized. The duration and scope of these initiatives varied, as well as the number of stakeholders involved. However, due to the lack of exact information about the number of stakeholders involved in every conducted initiative, it was impossible to pinpoint the exact number of involved stakeholders by initiative. According to the available data, rough estimates show that the average number is 4.84 stakeholders by an initiative.

The highest number of stakeholders participated in social and cultural development initiatives (Table 1). These stakeholders represented mostly various enterprises and media outlets. In general, enterprises represented a majority of stakeholders involved in the initiatives of the Foundation, followed by media outlets and entities from the non-governmental sector. Out of the six targeted fields, education, and the environment received the least attention and minimal support from media outlets and foundations. Government institutions participated in 19.33% of the initiatives. The involvement of the government sector indicates that the initiatives of the Foundation were recognized as positive and beneficial for the wider community.

Table 1. Percentage of stakeholders involved by the type and by the field in the period from 2013 to 2023

Stakeholder	Education	Economy	Environment	Health & Safety	Social & cultural development	Infrastructural development	Sum
Enterprise	2.52	4.20	4.20	4.20	10.08	5.04	30.25
Government institution	0.84	3.36	1.68	2.52	8.40	2.52	19.33
Media outlet	1.68	3.36	0	2.52	10.92	3.36	21.85
Non-governmental sector	2.52	5.04	1.68	3.36	5.04	4.20	21,85
Foundation	0	0.84	1.68	0.84	1.68	1.68	6.72
Sum	7.56	16.81	9.24	13.45	36.13	16.81	100

Source: Authors

Out of the initiatives, 23 of them, or 74.19%, were conducted just once, while the remaining 25.81% were implemented for at least two consecutive years. The initiatives with the longest implementation time were connected to the fields of economy and social and cultural development (Table 2), while the field of infrastructural development was not involved in any long-term initiative.

Table 2. Duration of the initiatives (expressed in %) realized in the period from 2013 to 2023.

Duration of implementation	Education	Economy	Environment	Health & Safety	Social & cultural development	Infrastructural development	Sum
Less than 5 years	3.70	9.26	11.11	12.96	31.48	12.96	81.48
More than 5 years	3.70	5.56	1.85	1.85	5.56	0	18.52
Sum	7.41	14.82	12.96	14.81	37.04	12.96	100

Source: Authors

The most notable initiatives implemented for a longer period, from 2013 to 2019, and involving the support from a variety of influential stakeholders, were Youth Fair and Youth Heroes. The Youth Fair represented a regional youth tourism fair that aimed to position the Balkans as a highly attractive destination for youth tourism. The potential of youth tourism, which would allow the countries of the Balkans to achieve significant financial resources, was recognized and thus supported by OPENS, an association of local youth organizations, the Tourist Organization of the City of Novi Sad, and other travel agencies and NGOs that deal with regional connections of young people in the Western Balkans (Internet 10). *Youth Heroes* aimed to showcase young, successful individuals in Serbia across various fields such as education and science, entrepreneurship, creative industries, social activism, culture, and art. The initiative, implemented with the support of the NIS company, aimed to inspire, instill pride, and showcase exceptional individuals who would serve as role models for other young people (Internet 2).

Long-term initiatives that were implemented in 2023 were State of EXIT Zone and Pixelate. The State of EXIT Zone has been an ongoing initiative since 2013. It involves a specially designated zone at the EXIT festival that serves as a platform for young people to meet and exchange ideas about regional support and cooperation, engaging in workshops, panel discussions, exhibitions, and other activities. The Zone features 50 organizations and institutions from Serbia and Europe, which include influential stakeholders such as UNICEF and Heineken (Internet 11). Pixelate is an interesting initiative conducted in collaboration with the

Recan Foundation. It focuses on creating art using cans to raise awareness about the importance of recycling and environmental protection (Internet 12).

Analyzing the initiatives, it was determined that 83.87% were adapted to all ages. A special focus on the younger population was placed within five initiatives, of which the four initiatives State of EXIT Zone, Youth Fair, Pixelate, and Youth Heroes were also the ones with the longest implementation period. These results are not surprising considering that young people represent the target group of the EXIT Festival.

Because of the limited information that is available to the public, the social, economic, and other long and short-term effects of the initiatives were unable to be identified, and therefore any predictions connected to them were excluded from the research.

DISCUSSION AND CONCLUSION

The research paper aimed to conduct a retrospective review of the socially responsible activities conducted by the EXIT Foundation since its establishment in 2013. The objective was to identify which field (education, economy, environment, health and safety, social and cultural development, infrastructural development) has been the Foundation's primary focus, which fields have been neglected and where more attention could be directed in future initiatives.

Observing the results obtained from the online research, it is evident that the target group of the EXIT Foundation is the younger population. The topics, activities, and ways of promoting the initiatives are adapted to their needs. This observation is in line with the goals of the EXIT Foundation, among which the development of young people stands out as a priority activity. The focus on one target group allows for a better alignment with the needs and expectations of visitors and the efficient allocation of available resources (Camilleri, 2018). Consequently, the EXIT Festival has successfully maintained its popularity.

The research also identified a variety of stakeholders including those from the economic, governmental, and non-governmental sectors, providing continuous support and involvement, and recognizing the positive impact of the EXIT Foundation's initiatives beyond the local level. Research conducted in 2010 by "Booz, Allen, Hamilton Inc" focused on the effects of the EXIT festival on the local economy and the direct and indirect benefits to local and national businesses. It concluded that the overall estimated benefits of the festival outweigh the costs, with the estimated impact on the economy and revenues of Novi Sad equaling 13.3 million euros with a multiplication coefficient of 1.9, and the effect on the Serbian economy reflected in revenues of 10.9 million euros with a multiplication coefficient of 2.7 (Prodanovic-Stamenovic, 2015). According to the research published by "TIM Center" in 2022, that year the EXIT Festival contributed an incredible 19.7 million euros to the economy of Serbia. In addition to economic benefits, the EXIT Festival also contributes to the improvement of the image of Novi Sad and Serbia and their promotion as attractive destinations. The EXIT festival also represents a powerful event that can have a great impact on the lives of individuals. Festivals can create an unforgettable experience that will evoke positive feelings in every future association with it, and they influence the building and improvement of relationships with other participants and create a sense of belonging and community (Wilmink, 2023). A "TIM Centar" survey also found that 86% of respondents believed that the EXIT Festival had a positive impact on their mental health (Internet 1). These beneficial effects could be the main reason why the festival gains support from a variety of stakeholders.

Socially responsible initiatives, implemented by the EXIT Foundation over the years, often addressed several topics and combined fields. This multidimensional approach makes it challenging to identify a single field as the Foundation's primary focus. However, based on the research findings, the field of social and cultural development appears to be emphasized the most, followed by the economic and health and safety fields. Contrastingly, Zorzin (2019) identified an economic logic underlying the Foundation's activities, highlighting the temporary privatization of public spaces, like the Petrovaradin Fortress, for profit, coupled with the socialization of costs. Zorzin criticized the lack of investment in the fortress, noting its adverse effects

on cultural heritage and the local population, which experiences limited and short-term benefits. Similarly, Živanović and Nikolić (2019) argued that the EXIT Foundation, as a high-influence stakeholder, has failed to adequately maintain the Petrovaradin Fortress, effectively mismanaging this public space.

Based on the collected data, it remains difficult to determine which field should be prioritized in the upcoming initiatives. The author proposes to focus on the environment, followed by the fields of health and safety and social development and culture. Considering the venue of the EXIT Festival, it is not surprising that the field of environment should be one of the priorities. Due to the cultural significance of the Petrovaradin Fortress, which was placed under the protection of the state because of its value, serious debates have been conducted over the years. Although the Fortress contributes to the attractiveness of the festival itself, it suffers negative impacts on the building and its surroundings. Environmental damage, degradation of green areas, noise, and excessive number of visitors (Pavluković et al., 2019) are just some of the factors that have been highlighted over the years as valid reasons for the relocation of the EXIT Festival. If certain measures were taken, they would contribute to the preservation of the given location and the reduction of its negative impacts, the need for the relocation of the festival venue would be reduced and the conditions that would enable the Petrovaradin Fortress to be added to the UNESCO World Heritage List would potentially be met (Besermenji, 2010).

The EXIT Foundation represents a successful business entity whose initiatives have had a significant positive impact not only on the local but also on the international community. The multidimensional approach of implemented socially responsible initiatives made it impossible to identify a key field that could potentially be considered a "favorite" of the EXIT Foundation. However, based on the impact achieved by the festival itself, the need to focus future initiatives on the dimension of environmental protection was identified. Devoting individual initiatives primarily to increasing awareness of the importance of the Petrovaradin Fortress would contribute to the preservation of this landmark and better valorization of resources.

The limitation of this research is primarily reflected in the lack of more precise data about the undertaken initiatives, which would enable clearer targeting of the fields that they include. Furthermore, other challenges include the lack of data regarding the impact achieved by the given initiatives and the lack of cooperation with the EXIT Foundation in getting key information about their socially responsible activities. Future research could focus on the effects of certain initiatives implemented by the foundation over a specific period. Moreover, if cooperation with the EXIT Foundation was achieved and access to certain information was provided, the given research could be completed and thereby enable the identification of the target field of the EXIT Foundation.

REFERENCES

Anheier, H. K. (2018). Philanthropic Foundations in Cross-National Perspective: A Comparative Approach. *American Behavioral Scientist*, 62(12), 1591–1602. https://doi.org/10.1177/0002764218773453

Baade R., Baumann R., Matheson, V. (2006). Selling the big game: Estimating the economic impact of mega-events through taxable sales. *Economics Department Working Papers*. Paper 83. https://crossworks.holycross.edu/econ_working_papers/83

Besermenji, S., Pivac, T., Wallrabenstein, K. (2010). Attitudes of experts from Novi Sad on the use of the authentic setting of the Petrovaradin fortress as the venue for the exit festival. *Geographica Pannonica*, 14(3), 92–97. https://doi.org/10.5937/geopan1003092b

Camilleri, M. A. (2018). Market Segmentation, Targeting and Positioning. *Travel Marketing, Tourism Economics and the Airline Product*, Chapter 4, pp. 69-88. Cham: Springer. Doi:10.1007/978-3-319-49849-2_4

Galt, K. A., Paschal, K. A. (2009). *Foundations in Patient Safety for Health Professionals*. Sudbury: Jones and Bartlett Publishers.

Gnade, H., Blaauw, P. F., Greyling, T. (2017). The impact of basic and social infrastructure investment on South African economic growth and development. *Development Southern Africa*, 34(3), 347–364. https://doi.org/10.1080/0376835x.2017.1308854

Goodman, J., Korsunova, A., Halme, M. (2017). Our Collaborative Future: Activities and Roles of Stakeholders in Sustainability-Oriented Innovation. *Business Strategy and the Environment*, 26(6), 731–753. https://doi.org/10.1002/bse.1941

Gorski, H., Fuciu, M., Croitor, N. (2014). Research on Corporate Social Responsibility in the Development Region Centre in Romania. *Procedia Economics and Finance*, 16, 224–233. https://doi.org/10.1016/s2212-5671(14)00795-3

Green, S. K. (2004). Bioterrorism and health care reform: no preparedness without access. *AMA Journal of Ethics*, 6(5). https://doi.org/10.1001/virtualmentor.2004.6.5.pfor2-0405

Greenwood, M. (2007). Stakeholder Engagement: Beyond the Myth of Corporate Responsibility. *Journal of Business Ethics*, 74(4), 315–327. https://doi.org/10.1007/s10551-007-9509-y

Heslop, J., Tomaney, J., Morgan, K. (2019). Debating the foundational economy. *Renewal*, 27, 5-12.

Hunyadi, Z. (2004). *Festival's public, role and place in cultural consumption*. Magyar Művelődési Intézet.

Ismail, M. (2009). Corporate Social Responsibility and its role in community development: an international perspective. *The Journal of International Social Research*, 2: 199-209.

Internet 1: https://www.exitfest.org/o-nama (Last accessed August 15, 2023)

Internet 2: https://www.exitfondacija.org/o-nama/ (Last accessed August 15, 2023)

Internet 3: https://www.globaleffect.org/ (Last accessed August 15,2023)

Internet 4: https://www.exitfondacija.org/en/projects/youth-heroes/ (Last accessed September 16, 2024).

Internet 5: https://www.exitfondacija.org/en/projects/exit-aid/ (Last accessed September 16, 2024).

Internet 6: https://consciousrevolution.life/about-us/ (Last accessed September 16, 2024).

Internet 7: https://www.exitfondacija.org/en/projects/stayclean/ (Last accessed September 16, 2024).

Internet 8: https://www.exitfondacija.org/en/projects/silent-balkans-majority/ (Last accessed September 16, 2024).

Internet 9: https://www.exitfondacija.org/en/projects/observatory-reconstruction-at-petrovaradin-fortress/ (Last accessed September 16, 2024).

Internet 10: https://www. exitfondacija.org/en/projects/youth-fair/ (Last accessed August 15, 2023).

Internet 11: https://www.exitfondacija.org/projekti/state-of-exit -zone/ (Last accessed August 16, 2023).

Internet 12: https://www.exitfondacija.org/oznaka/pixelata/ (Last accessed August 16, 2023).

Levy, K., Toepler, S., Wang, Q. (2023). *Chinese Government/Foundation Relationships in Global Perspective: A Conceptual Comparison*. Conference: International Seminar on Government-Nonprofit Relationships Hangzhou: Zhejiang University.

Leśna-Wierszołowicz, E. (2016). Corporate social responsibility as an element of building competitive advantage. *Studia i Prace WNEiZ*, 43, 55–64. https://doi.org/10.18276/sip.2016.43/1-05

Little, B. F. P. (1995). Industry's Response to the Green Movement. *Journal of the Korean Society of Analytical Sciences*, 8(4), 371-374.

Marco-Fondevila, M., Moneva Abadía, J. M., Scarpellini, S. (2018). CSR and green economy: Determinants and correlation of firms' sustainable development. *Corporate Social Responsibility and Environmental Management*, 25(5), 756–771. https://doi.org/10.1002/csr.1492

Matten, D., Moon, J. (2008). "Implicit" and "Explicit" CSR: A Conceptual Framework for a Comparative Understanding of Corporate Social Responsibility. *Academy of Management Review*, 33(2), 404–424. https://doi.org/10.5465/amr.2008.31193458

Montolio, D. (2018). The effects of local infrastructure investment on crime. *Labour Economics*, 52, 210–230. https://doi.org/10.1016/j.labeco.2018.02.006

Noga, T., Le Viet-Błaszczyk, M. (2023). The Role of Selected Themes and Formats in Social Media Marketing Communication of CSR Activities. *European Research Studies Journal*, 26(2), 562-576. https://doi.org/10.35808/ersj/3189

Oster, C. A., Deakins, S. (2018). Practical Application of High-Reliability Principles in Healthcare to Optimize Quality and Safety Outcomes. *JONA: The Journal of Nursing Administration*, 48(1), 50–55. https://doi.org/10.1097/nna.0000000000000570

Panthong, S., Taecharungroj, V. (2021). Which CSR Activities Are Preferred by Local Community Residents? Conjoint and Cluster Analyses. *Sustainability*, 13(19), 10683. https://doi.org/10.3390/su131910683

Pavel, A., Moldovan, B., Neamtu, B., Hintea, C. (2018). Are Investments in Basic Infrastructure the Magic Wand to Boost the Local Economy of Rural Communities from Romania? *Sustainability*, 10(10), 3384. https://doi.org/10.3390/su10103384

Pavluković, V., Armenski, T., Alcántara-Pilar, J.M. (2019). The Impact of Music Festivals on Local Communities and Their Quality of Life: Comparation of Serbia and Hungary. In: Campón-Cerro, A.M., Hernández-Mogollón, J.M., Folgado-Fernández, J.A. (eds) Best Practices in Hospitality and Tourism Marketing and Management. Applying Quality of Life Research. Springer, Cham. https://doi.org/10.1007/978-3-319-91692-7_11

Peličić, D, Radunović, D., Bokan, D. (2015). Osnovi metodologije naučno-istraživačkog rada. *Inspirium*, 12, 2-7.

Phillips, S. D. (2018). Dancing with giraffes: Why philanthropy matters for public management. *Canadian Public Administration*, 61(2), 151–183. https://doi.org/10.1111/capa.12273

Pivac, T., Blesic, I., Kovacic, S., Besermenji, S., Lesjak, M. (2019). Visitors' satisfaction, perceived quality, and behavioral intentions: the case study of exit festival. *Journal of the Geographical Institute Jovan Cvijic*, SASA, 69(2), 123–134. https://doi.org/10.2298/ijgi1902123p

Prodanović-Stamenović, A. (2015). *Comparative impacts of music festivals on local communities and tourism - EXIT versus SZIGET*. PhD thesis. University of Novi Sad, Department of Geography, Tourism and Hotel Management.

Rockefeller Philanthropy Advisors (2019). *Philanthropy in Higher Education - Priorities and Approaches of Private Foundations*. TIAA Institute

Rosener, A. (2013). Resource Review of Leveraging the Power of Foundations: An Analysis of Program-Related Investing. *The Foundation Review*, 5(3). https://doi.org/10.9707/1944-5660.1173

Sessions, K., Fortunato, K., Johnson, P. R. S., Panek, A. (2016). Foundations Invest In Environmental Health. *Health Affairs*, 35(11), 2142–2147. https://doi.org/10.1377/hlthaff.2016.0866

Shapiro, R. J., Mathur, A. (2008). *The Social and Economic Value of Private and Community Foundations*. Washington, DC: The Philanthropic Collaborative.

Shelton, G. (2017). *The Economic Impact of Festivals on Small Towns*. Tennessee Certified Economic Developer Certification Program.

Slob, B., Oonk, G. (2007). *The ISO Working Group on Social Responsibility: Developing the future ISO SR 26000 Standard*. SOMO Briefing Paper.

Someshwari, M., Laxmana, P. (2020). Corporate Social Reporting in India - An Overview. *Tathapi (UGC Care Journal)*, 19(52), 261.

Thomsen, S., Hansmann, H. (2013). The Performance of Foundation-Owned Companies. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2406055

Tsundoda, T., & Mendlinger, S. (2009). Economic and social impact of tourism on a small town [Peer commentary on the journal article "J. Service Science & Management" by T. Tsundoda, & S. Mendlinger]. *SciRes*, 2(61), 61-70.

Toepler, S. (2017). Public Philanthropic Partnerships: The Changing Nature of Government/Foundation Relationships in the US. *International Journal of Public Administration*, 41(8), 657–669. https://doi.org/10.1080/01900692.2017.1295462

Vincent, C., Amalberti, R. (2016). *Safer Healthcare: Strategies for the Real World*. Cham: Springer. doi: 10.1007/978-3-319-25559-0

Vuković M., Štrbac N. (2019). *Methodology of scientific research*. Bor: Technical Faculty.

Wilmink, A. (2023). *The Influence of Music Festivals on Young Adult's Mental Well-Being*. Bachelor Thesis. Modul University Vienna.

Wood, L., Lithauer, P. (2006). The "added value" of a foundation program. *South African Journal of Higher Education*, 19(5). https://doi.org/10.4314/sajhe.v19i5.25541

Zolfaghari, B., Hand, G. D. (2021). Impact investing and philanthropic foundations: strategies deployed when aligning fiduciary duty and social mission. *Journal of Sustainable Finance & Investment*, 13(2), 962–989. https://doi.org/10.1080/20430795.2021.1907090

Zorzin, N. (2019). *Privatization of a Common? A Focus on Exit Festival*. DOSSIER: PETROVARADIN Managing Historic Urban Landscapes.

Živanovic, K., Nikolić, D. (2019). *Management Structure, Interests and Visions of Petrovaradin Fortress Stakeholders*. DOSSIER: PETROVARADIN Managing Historic Urban Landscapes.

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THE IMPACT OF URBAN REGENERATION ON TRANSFORMING THE IMAGE OF A DECLINING DISTRICT: THE CASE OF THE BARDO DISTRICT IN CONSTANTINE (ALGERIA)

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ABSTRACT

This article explores the urban regeneration project of an old, decaying district called Bardo, located in the city center of Constantine, Algeria, examining its impact on the physical transformation of the district and its image, as well as the reactions of the local population. The study focuses on the conversion of a former shantytown into an urban park, the beautification of the riverside area, and the resulting changes in the neighborhood's perception. The research utilizes a qualitative methodology, including interviews with stakeholders and analysis of historical and administrative documents. It finds that while the urban park has significantly enhanced the city's landscape and created a new public space, the project's focus on visual appeal has not fully addressed the underlying social and economic challenges faced by residents. The project's success in attracting tourism and investment comes at the expense of neglecting long-term community needs, raising concerns about the sustainability and equity of development. Ultimately, the study argues that urban regeneration projects must adopt a holistic approach that considers the social and economic needs of local communities, going beyond purely aesthetic transformations to create inclusive and equitable urban environments.

Keywords: *urban regeneration - urban wasteland - urban requalification - Bardo - Constantine.*

INTRODUCTION

The globalization of large urban projects has driven cities into a competitive landscape (Cusin, Damon, 2010; Oosterlynck, González, 2013; Charnock, Purcell, Ribera-Fumaz, 2014). This competition has led to a heightened emphasis on urban attractiveness and marketing (Appert, Huré, Languillon, 2017; Lotz-Coll, 2021). Furthermore, cities are now acting as laboratories for revitalizing declining, crisis-stricken, or struggling neighborhoods through urban renewal strategies within a context of metropolitanization (Guieysse, Rebour, 2014).

Moreover, these upheavals generally leave their mark on the urban fabric (Lotz-Coll, 2021) and on the values of places already occupied and practiced (Viel et al, 2012, Appert M., Huré M., Languillon R., 2017), including: revitalizing central spaces and boosting tourist appeal (Semple, 2017), enhancing potential (Eckardt, AlSadaty, 2023), changing the appearance and urban landscape (Appert, Montès, 2015), improving the way

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space functions by redistributing activities, social groups and flows (Harris, 2015) to encourage their insertion into the city and contribute to its sustainability.

Like other countries in the Maghreb, Algeria has undergone an overhaul of how it produces urban spaces in the last two decades, following the end of the black decade1 and the increase in hydrocarbon revenues. This overhaul has seen a shift from "extension urbanism" due to urban sprawl to "a return to the city" (Saidouni, 2001; Sidi Boumedine, 2013) through the multiplication of urban regeneration projects in existing urban fabrics. Indeed, the country's leaders are seeking to give a positive image of modernity to their major cities and endow them with the attributes of "attractive places" through these projects to join the ranks of metropolises in the image of the development of waterfronts and riverbanks, the reconversion of urban wastelands and the requalification of historic, peripheral and insalubrious housing districts, the enhancement of historical and cultural heritage, the urban landscape and public space (Cattedra, 2010; Azzag, 2012; Kettaf, 2013). This is in line with the "PAT18" Territorial Action Program entitled "Urban Renewal and City Policy" of the SNAT 2030 National Spatial Planning Scheme (MATET, 2008).

However, these large-scale projects generate transformations in the urban space of Algerian cities through the assignment of new spatial distributions (new functions) in neighborhoods, the transformation of existing urban fabrics, the emergence of new centralities and urbanities (new towns), changes in landscapes, the construction of new identities and representations of place through the reconversion of brownfield sites (Cattedra, Legros, Iraki, 2010; Signoles, 2014; Belguidoum et al, 2015). With this in mind, our field of investigation is the city of Constantine, the capital of eastern Algeria. Faced with its dysfunctions and the alarming degradation of its urban landscape, this city in decline (Arab, 2018) has undergone an effervescent spatial transformation of its fragile territory since the 2000s in a process of metropolization. Moreover, its potentialities and weaknesses singularize the very nature of the problems to be addressed by urban planning.

On the other side, the city's most striking features are i) its city center, which has been emptied of its population and cleared of run-down sites as part of the national policy of resorption of precarious housing, the ultimate and most relentless means to "de-slum" the city; ii) the appearance of the new "Ali Mendjeli" town on its outskirts as an asset to accommodate relocated populations and relieve congestion in the central city; iii) the launch of the "Constantine Metropolis Modernization Project PMMC" in 2007, as a global project overseen by the highest levels of government; iv) the designation of "Constantine, Capital of Arab Culture CCCA for 2015" as the city's attractiveness and development strategy (Pradel, 2013).

Moreover, this modernization aimed to endow the city of Constantine with the attributes and characteristics of a regional metropolis (PMU, 2011), all the while conferring a brand image on the "new Constantine" (PMMC, 2007). Within this city project, the public authorities sought to reinvest in the declining and marginal parts of the city for regeneration by transforming land use (PMMC, 2007).

In this respect, Bardo2, a former working-class 150 ha, enclave in the city center of Constantine, is the subject of our study (Figure 1). The latter was reinvested by local authorities as a major stakeholder in urban planning and development operations in Algeria (Sidi Boumedine, 2013), as part of the modernization of the city of Constantine to turn the existing shantytown into a central district dubbed "viva-cité" (Cherrad et Al, 2007), in a "process of verticalization" (Appert, Huré, Languillon, 2017) in the image of Persian Gulf neighborhoods.

Moreover, the legitimization of "demolition-delocalization" was reinforced by the conjuncture of the completion of the "Trans-Rhumel" viaduct, another pioneering modernization project overlooking the great Bardo. However, this "flagship project" of urban renewal takes the form of a territorial marketing and tourism promotion operation to brand the city and attract investors and multinational companies (Fainstein, 2008; Viel et al, 2012).

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[1] It refers to the 90s, a period of decline, insecurity and political and economic instability caused by terrorism

[2] The district's population was estimated at 28,141 inhabitants, including 2,825 structures, which comprised 4,854 dwellings and were occupied by 5,706 families, according to the General Population and Housing Census (RGPH) in 2008. Bardo encompasses all areas of precarious, dilapidated and degraded housing, including Rahmani Achour Avenue, the Orange camps, Roumania Avenue , the Bentellis housing estates, Pine Chalet, Bidi Louiza, Peupliers, Muriers and the Roman Arches zone.

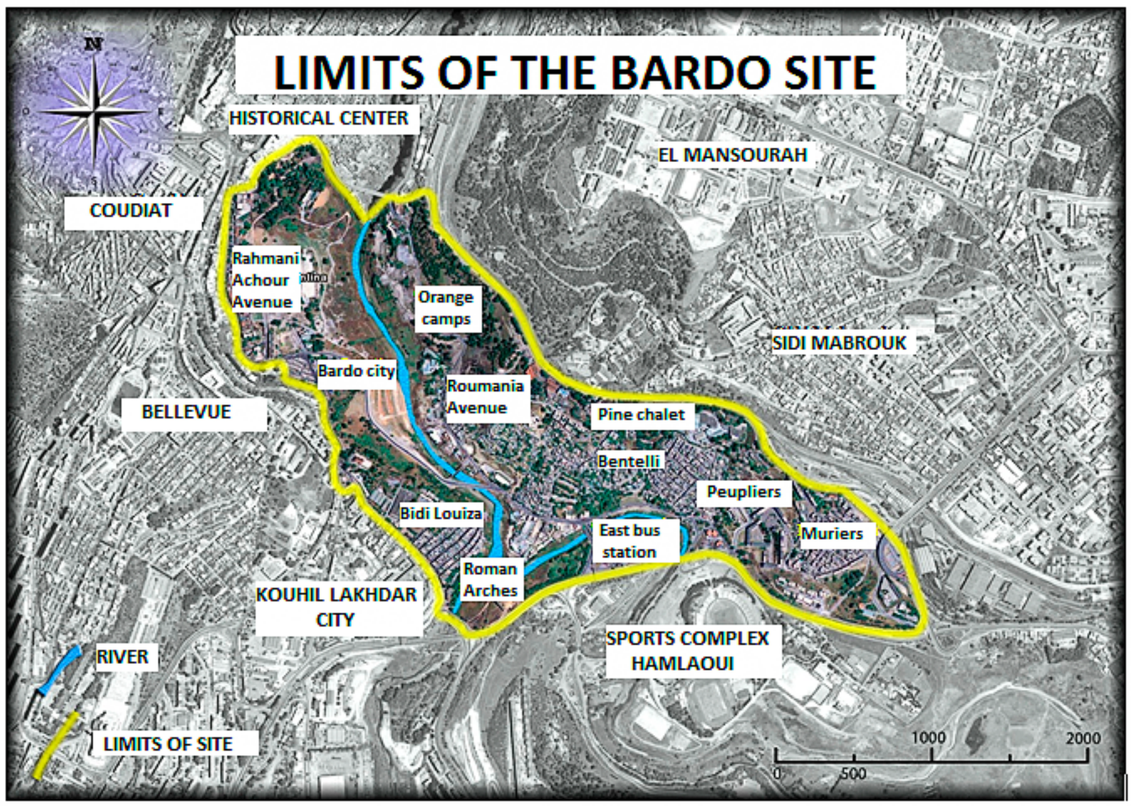

Figure 1. Location and limits of the Bardo district in the city center of Constantine

Source: DUAC of Constantine, 2010 + author's treatment

Nevertheless, this singular experiment with a "structuring effect" on the city led to the physical transformation of urban space through: the absorption of shantytowns on the banks of Oued Rhumel[3] and the eradication of the popular district[4]; the relocation of their populations to the new "Ali Mendjeli" town; the conversion of the urban wasteland (65 ha) into an "urban park"; the enhancement of the landscape and historical heritage and the requalification of the riverside area in 2014[5].

In this respect, this "flagship project" goes beyond the simple production of space (Max Raynaud, 2014) and consists of creating and multiplying "iconic high places" (Guéraiche, 2014) as part of the metropolization process, and arouses significant political interest due to the impacts sought on its insertion environment (Max Raynaud, 2014). With this in mind, the aim of our research is to examine the impact of the urban regeneration of Bardo on the physical transformation of the district and its image, shedding light on the reaction of its local population and day-to-day users.

METHODS AND DATA

To achieve the research objective, our methodology is qualitative, based on a descriptive and analytical study of the urban project in the Bardo district of Constantine. This approach, inspired by Lefebvre (1974), enables a deeper understanding of the urban project by analyzing the historical, spatial and social dimensions of its development, through the triptych: space designed, conceived and experienced.

The first phase of our research consisted of building a solid theoretical framework, based on an in-depth analysis of scientific research related to our research theme. This analysis enabled us to identify the main trends and issues related to urban projects, as well as the investigative methods most relevant to our study.

Press monitoring and content analysis of historical and administrative documents at the Constantine Wilaya Archives Center, the Department of Urban Planning, Architecture and Construction (DUAC), the Environmental Department and the Land Conservation Agency proved crucial in reconstructing the evolution

[3] This operation is being carried out as part of the national policy of resorption of precarious housing, launched in the 2000s, the main aim of which is to have cities without shantytowns and reintegrate declining neighborhoods into the city's dynamic.

[4] The operation was carried out between 2008 and 2010 as part of the PMMC project to modernize the Constantine metropolis, initiated in 2005 with the installation of Abdelmalek Boudiaf as Wali (prefect) of Constantine.

[5] These latest operations to convert the urban wasteland into an "urban park" (to be completed between 2014 and 2022), enhance the historical and landscape heritage and redevelop the riverside area were carried out as part of the preparations for the international celebration of "Constantine, Capital of Arab Culture 2015".

of the Bardo urban project. This step enabled us to distinguish the different phases of the project: i) Space designed by decision-makers since 2007 (Viva-cité): this phase corresponds to the project's initial conception, influenced by the visions and policies of local and national decision-makers. ii) Space conceived and realized by specialists since 2014 (urban park): this phase marks the intervention of urban planning and architecture specialists, who implemented the initial plans and shaped the neighborhood's physical space. iii) Space experienced by its users since 2022 (botanical garden): this phase highlights the appropriation of the urban project by Bardo's inhabitants and its impact on their lifestyles and perceptions of space.

In addition, observation in situ and taking photographs were essential to complete our analysis. Using the landscape reading method (Relph, 1976), we were able to observe the transformations of Bardo's urban environment and landscape by comparing photos taken before the neighborhood was eradicated with those taken recently during the field survey. This approach enabled us to understand the interactions between the physical elements and the socio-cultural dimensions of the urban project.

In order to obtain in-depth information on the interventions (planned and carried out) in the Bardo urban project, semi-directive interviews (Kvale, 2007) were conducted between February 2021 and May 2024, with representatives of the administrative bodies involved in the Bardo urban project, namely: the Directorate of Urban Planning, Architecture and Construction (DUAC); the Directorate of the Environment; the Land Conservation Agency. These interviews, based on a qualitative approach, aimed to understand the perceptions and motivations of the institutional players involved in the urban project. Further semi-directive interviews were conducted with the urban park management company (EDEVCO) and the investor in the project (MEGA), as well as with the local population. These exchanges explored the concrete realities of operating the project, highlighting the challenges and opportunities encountered (Yin, 2014).

RESULTS

Each urban regeneration project is committed to generating unique value, based on local conditions, the collaboration of distinct actors and the creation of context-specific effects. With this in mind, the results of our empirical work can be summed up in significant transformations of the neighborhood's physical space and its image, namely: the conversion of the urban wasteland into an urban park, the enhancement of an urban landscape rich in potential, and the urban requalification of the riverside area.

Enhancing the urban landscape by converting brownfield land into an urban park

Urban wastelands are "veritable cancers in the landscape" (Forbras, 2001), leading to the decline and degradation of neighborhoods. In this respect, their reclamation is an opportunity to reclaim land in the city to densify it (Delachaux, 2010), to materialize the urban environment and its organization (Banzo, 2015) and to reappropriate space for its inhabitants (Lotz-Coll, 2021). Bardo's urban regeneration, on the other hand, has been achieved by reconverting the urban wasteland (65 ha) created after the eradication of precarious dwellings, which their occupants called "Arab houses" of vernacular architecture, into an urban park. This redevelopment has changed the site's appearance, giving it a new vocation, and transforming it from a working-class housing district into an amusement and leisure park in the heart of the city.

Consequently, this reintegration of the evacuated site into the existing urban fabric, which has been relieved of its stigmatized negative appearance, is an opportunity to recompose and energize the city center (Julien, Theyes, 2011), creating a symbolic space with an "outreach effect" and which contributes to the tourist appeal of the regional capital, while ensuring a viable and livable urban framework for the local population and everyday users.

From an external perspective, the Bardo urban park contributes to the creation of a naturalized space (plant and mineral) and the promotion of nature in the city (the forest and the river) through the purifying blue and green colors. As with any green lung in the city, this park gives a positive image to the future metropolis, thanks to its ecological aspect, which reduces air pollution, softens temperatures and provides visual and olfactory comfort.

Indeed, this urban transformation is illustrated in Figures 2 and 3, by comparing the photographs taken before the eradication of the district by the Wilaya of Constantine and the land conservation agency, which show the disastrous situation of the working-class district and the blighted appearance of the city center, with those of the current state of the site taken by the author, which in turn illustrate the change in the physiognomy of the site.

Figure 2. General views of Bardo before its eviction

Source: Constantine province, 2007

Figure 3. General views of Bardo after its conversion into an urban park

Source: Author, March 2023

The urban park incorporates two preserved buildings: the former "Métatla Taher" school, now an educational agricultural center, and the "Imam Malek Ibn Anes" mosque, which has been restored to maintain its religious vocation (Figure 4).

Figure 4. Buildings reinvested in the urban park

Source: Author, April 2024

In addition, the site has been revitalized through the redistribution of investments (Appert, Huré, Languillon, 2017) at its level, reinforcing its educational and didactic vocation through attraction activities as a lever for economic profitability (Pradel, 2013) through the multi-purpose concentration of consumer services and play and rest areas. This action offers an opportunity for job creation (Table 1), a major objective of urban revitalization projects, as it contributes to reducing unemployment and improving people's living conditions (Getz, 2008; Beatley, 2014).

Table 1. Jobs created in the urban park

FUNCTION	NUMBER OF EMPLOYERS
Security guards	62
Multi-skilled workers	14
Gardeners	02
Maintenance workers	06
Mechanics	01
Maintenance technicians	03
Cashiers	06
Shopkeepers	20
Games operators	35
Administrative staff (EDEVCO, MEGA)	06
Total number	155

Source: Author, based on field survey, May 2024

Nevertheless, it's important to note that the recruitment of security guards and game operators has given priority to local residents, both housed and local. This recruitment strategy, based on the concept of "user-experts of the site" (Noyer J., Raoul, 2008), aims to involve local residents in the management of the park and encourage local ownership of the project, plus the social and professional integration of the latter and the reduction of feelings of marginalization and exclusion. This approach, confirmed by the park manager "MEGA LAND" (interview conducted on 14-05-2024), promoted social inclusion and citizen participation and is in line with the principles of sustainable development and social justice (Pradel, 2013; Beatley, 2014).

However, the development of an urban park in Bardo, over and above the embellishment of the physical space, has triggered a profound transformation of the neighborhood's negative image, impacting residents' pride and its external perception, making it more attractive in the eyes of residents, visitors and even (Kallus, 2009). This change in visibility is reported in the media and national press by several expressions as a kind of marketing operation (Kallus, 2009) to give the neighborhood a positive image:

- "A large central park in the Bardo district of Constantine"
  (Emergent Maghreb, 15-11-2012)
- "Bardo City Park fills up with visitors"
  (Oran Daily Newspaper, 25-03-2019)
- "Bardo urban park: a major project turned into a fiasco"
  (East of Algeria, 6-09-2020)

The embellishment of the riverside area without any real urban redevelopment

Requalification is an action that covers the transformation, mutation, restructuring and rebirth of part of the housing stock that is often destined for destruction in urban projects (Perrocheau, 2012). With this in mind, the Bardo riverside area was subject to urban requalification operations following the resorption of Bardo's insalubrious housing (65 ha).

Firstly, Avenue Rahmani Achour, known as "Trik Bardo" (formerly Rue d'Angleterre), is characterized by its dilapidated colonial fabric and high-rise apartment buildings dating from the post-independence era. This first zone has seen no urban improvement, despite suffering from several dysfunctions: anarchic and spontaneous urbanization, deterioration of the built environment, rural-urban behavior, informal trade and, above all, the phenomenon of "ghettoization" (Berry-Chikhaoui, 2009). However, the neglect of these triggers for urban requalification operations (Wachter, Emelianoff, 2009) has led to a series of protests by local residents demanding that they be rehoused in view of the deterioration in their living conditions and environment (Figure 5).

Figure 5. Condition of Avenue Rahmani Achour

Source: Author, May 2024

To deal with this chaotic situation, the former director of Constantine's land agency confirmed that: "the dwellings on this Avenue were intended to become a physical barrier between the city and the urban wasteland that had been created, generating a masking effect to prevent the proliferation of the informal sector in the city" (Interview conducted on 25-01-2022). In this vision, this avenue (Figure 6) minimized the sense of insecurity (Lynch, 1960) caused by the "emptiness" and lack of purpose of the urban wasteland formed after the neighborhood's demolition. However, this visual barrier also reduced the negative image of the wasteland as a disturbing and marginal urban element (Soulier, 2004) and a degraded urban landscape (Merlin, Choay, 2010).

On the other hand, the other housing estates on the banks of the Grand Bardo (Figure 7) constitute a sector in difficulty, made up of squatter settlements (Bentellis, Chalet des pins, arcades romaines and Bidi Louiza) and degraded housing estates (cité des peupliers and des muriers). The area also boasts a number of elementary schools, mosques and basic shops. With this in mind, the reinvestment project for this troubled area aims to enhance the existing urban fabric by minimizing demolition and giving it new qualities, as an act of "political and economic reappropriation" (Gasnier, 2004).

However, this urban intervention is a work of embellishment of the "image of the city" (Lynch, 1960; Wachter, Emelianoff, 2009) through the rehabilitation of dwellings and the painting of facades in White and openings in Blue or Green to give this sector the appearance of a material heritage in the city, in the image

Figure 6. Rahmani Achour Avenue as a physical barrier between the city and the urban wasteland
Source: Author, March 2023

Figure 7. The riparian zone before its redevelopment
Source: Constantine Land Conservation Agency, 2007

of the traditional medina (Figure 8). In addition, this "requalification of the physical" (Wachter, Emelianoff, 2009) was reinforced by the installation of the international Marriott luxury hotel. To this end, a member of the Bentellis neighborhood committee reported the discontent of local residents who consider this rehabilitation operation as "a makeover" that has not been implemented to improve their living environment, but just to beautify the appearance of the housing estates and not offend the sensibilities of prestigious guests (Extract from an interview conducted on 06-04-2021), without redeveloping the various roadways and installing the various technical networks (electricity, telecommunications, water, heating, sanitation) and producing the public spaces relevant to the community (Citron, 2017).

Figure 8. The waterfront area after redevelopment

Source: Author, June 2024

Although the requalification of the disadvantaged Bardo riverside area has brought visual improvements to the appearance of the sector by whitewashing facades and eradicating the former Med Boudiaf shanty-town in Chalet des pins, it has fallen far short of meeting the objectives of the said intervention. These include, according to SNAT 2030, "the rehabilitation of housing in large estates and the elimination of substandard housing, the upgrading of basic facilities and services (connection to the AEP and sewerage networks, education, health, sports, culture, etc.), the allocation of abandoned buildings and the construction of new ones, the allocation of abandoned buildings with a view to reintegrating them into the urban fabric, the structuring of the urban fabric, urban integration, the development of public spaces (roads and green spaces) and the reclamation of the urban wasteland" (MATET, 2008).

In this respect, the operation carried out in the area around the Bardo district has been reduced to a simple "renovation of buildings", without a genuine requalification of the existing fabric or enhancement of the district's urban space. Figures 9 and 10 highlight the persistence of degradation in this area, particularly: degradation of public space and illegal appropriation, maintenance of traditional activities and informal practices (commerce), dominance of urban wasteland, degradation of biodiversity and environmental pollution, persistence of a stigmatized image due to unfinished constructions and the partial renovation of the urban facade, limited to the dwellings facing the Marriott hotel, undervaluation of historical (roman arches) and landscape heritage.

a

b

c

d

e

f

Figure 9. Degradation of public space, illegal appropriation and informal practices

Source; Author, June 2024

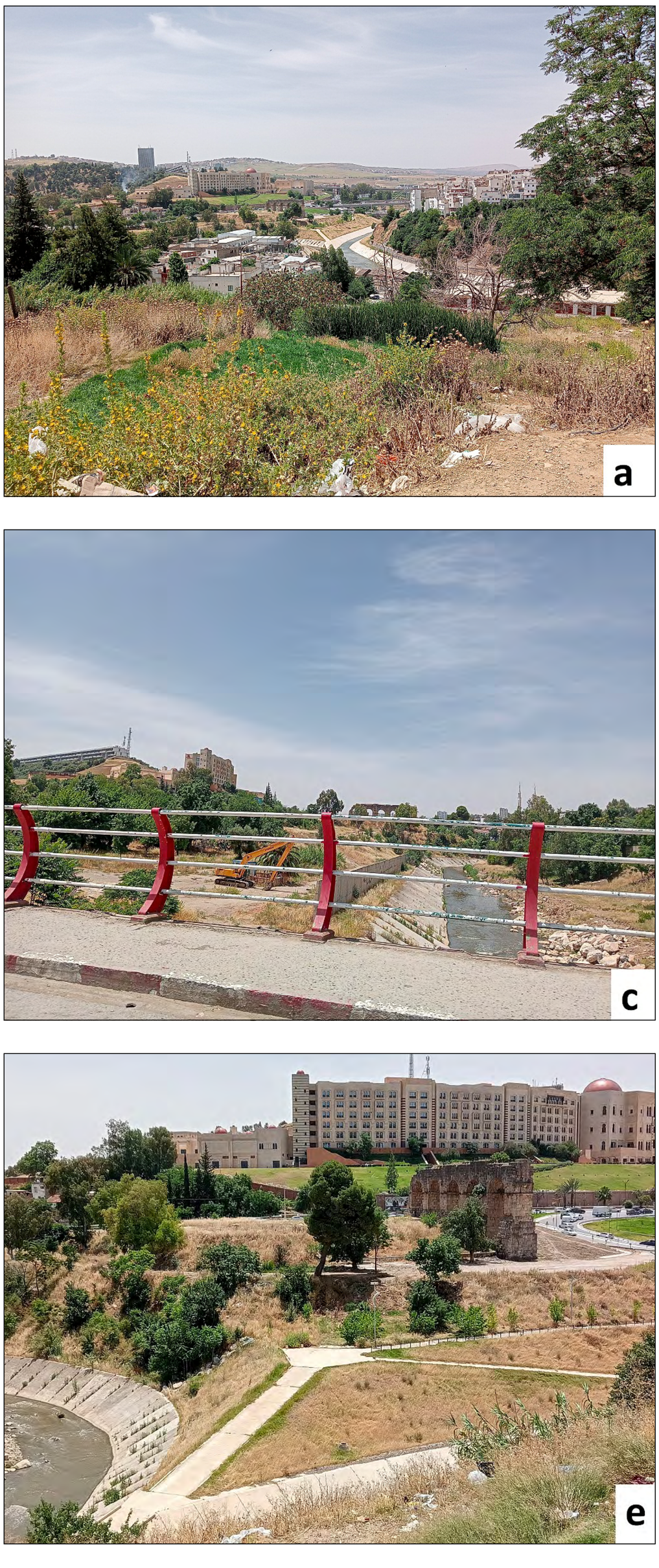

Figure 10. Partial renovation, degradation of the environment, enhancement of the historical and natural heritage

Source; Author, June 2024

CONCLUSIONS

The urban regeneration project in Bardo, Constantine, exemplifies the complexities of large-scale urban development in a globalized world. While aiming to transform a neglected urban wasteland into a vibrant, modern space, the project reflects the tensions between urban planning ideals and the realities of social and economic inequality.

The conversion of the former shantytown into an urban park represents a significant achievement, enhancing the city's landscape and creating a new public space for leisure and recreation. This transformation has also improved the neighborhood's image, contributing to the city's attractiveness and potentially boosting tourism. Furthermore, the project has created job opportunities, particularly for local residents, emphasizing social inclusion and participation.

However, the lack of significant urban redevelopment along the riverside highlights the project's limitations. While the physical beautification has improved the area's aesthetics, it has failed to address the underlying social and economic challenges faced by local residents. The absence of crucial infrastructure improvements and the limited impact on residents' daily lives highlight the project's focus on urban marketing and visual appeal over long-term community development.

This study highlights the critical need for a holistic approach to urban regeneration. While focusing on physical transformation is essential, it is equally crucial to consider the social and economic needs of local communities and to ensure that urban projects contribute to sustainable and equitable urban development. Further research should examine the long-term impacts of this project on local residents, including their experiences with displacement, economic opportunities, and access to services. This analysis will provide valuable insights into the effectiveness of urban regeneration initiatives and their potential to contribute to social justice and sustainable urban development.

REFERENCES

Appert, M., Huré, M., Languillon, R. (2017). Gouverner la ville verticale: Entre ville d'exception et ville ordinaire. *Géocarrefour*, 91, 2.

Appert, M., Montes, C. (2015). Skyscrapers and the redrawing of the London skyline: a case of territorialisation through landscape control. *Articulo - Journal of Urban Research*, Special issue 7. https://doi.org/10.4000/articulo.2784

Arab, N. (2018). Pour une théorie du projet en urbanisme. *Revue européenne des sciences sociales*, 56(1), 219-240. https://doi.org/10.4000/ress.4050

Banzo, M. (2015). L'espace ouvert pour recomposer avec la matérialité de l'espace urbain. *Articulo - Journal of Urban Research*, Special issue 6. https://doi.org/10.4000/articulo.2708

Belguidoum, S., Cattedra, R., Iraki, A. (2015). Villes et urbanités au Maghreb. *L'Année du Maghreb*, 12. https://doi.org/10.4000/anneemaghreb.2355

Berezowska-Azzag, E. (2012). *Projet Urbain, Guide méthodologique : Comprendre la démarche du projet urbain*. Alger: Synergie.

Berry-Chikhaoui, I. (2009). Les notions de citadinité et d'urbanité dans l'analyse des villes du Monde arabe, Essai de clarification. *Les Cahiers d'EMAM. Études sur le Monde Arabe et la Méditerranée*, 18, 9-20. https://doi.org/10.4000/emam.175

Cattedra, R. (2010). Chapitre I. Les grands projets urbains à la conquête des peripheries. *Les Cahiers d'EMAM*, 19, 58-72. https://doi.org/10.4000/emam.114

Cattedra, R., Legros, O., Iraki, A. (2010). Introduction. Territoires et politiques dans les périphéries des grandes villes du Maghreb. *Les Cahiers d'EMAM*, 19, 55-57. https://doi.org/10.4000/emam.110

Chaline, C. (1999). *La régénération urbaine, Que sais-je?* Paris: NDE.

Charnock, G., Purcell, T., Ribera-Fumaz, R. (2014). City of rents: the limits to the Barcelona model of urban competitiveness. *International Journal of Urban and Regional Research*, 38(1), 198–217. https://doi.org/10.1111/1468-2427.12103

Cherrad, S.E., Cherabi, A., Sahraoui, B., Bouledroua, A. (2007). Projet de modernisation de la métropole constantinoise (PMMC), *Wilaya de Constantine*.

Citron, P. (2017). Produire la ville grâce aux opérateurs immobiliers : quel modèle pour l'aménagement privé en zone dense? Métropoles, 20, 1–18. https://doi.org/10.4000/metropoles.5461

Delachaux, F. (2010). Les friches, enjeux de renouvellement. *Enquête environnement*, 1688.

Eckardt, F., AlSadaty, A. (2023). Urban Heritage in Transformation: Physical and Non-Physical Dimensions of Changing Contexts. *Urban Planning*, 8(1), 1- 4. https://doi.org/10.17645/up.v8i1.6633

Fainstein, S. (2008). Mega-projects in New York, London and Amsterdam. *International Journal of Urban and Regional Research*. 32(4), 768-785. https://doi.org/10.1111/j.1468-2427.2008.00826.x

Forbras, A. S. (2001). Noeux-les- Mines, un cas de reterritorialisation par les loisirs. *Hommes et terres du Nord*, 2. GéoProdig, portail d'information géographique. http://geoprodig.cnrs.fr/items/show/195412.

Gasnier, A. (2004). Requalification, ré-appropriation et urbanite. *Travaux et documents de ESO*, 21, 35-39.

Gueraiche, W. (2014). *Géopolitique de Dubaï et des Emirats Arabes Unis*. Nancy: Arbre bleu.

Guieysse, J.A., Rebour, Th. (2014). Crise, métropolisation, et aménagement, *Cybergeo: European Journal of Geography*, Current issues, Ville et capitalisme. http://journals.openedition.org/cybergeo/26636

Harris, A. (2015). Vertical urbanisms: Opening up Geographies of the Three-dimensional City. *Progress in Human Geography*, 39(5), 601-620. https://doi.org/10.1177/0309132514554323

Julien, M., Theyes, B. (2011). *Friches urbaines et logistique urbaine*. Disponible sur: http://www.developp ment-durable.gouv.fr/Friches-urbaines-etlogistique.html

Kettaf, F. (2013). *La fabrique des espaces publics: conceptions, formes et usages des places d'Oran (Algérie)*. Thèse de doctorat. Montpellier: Université Paul Valéry, Départment de géographie.

Lefebvre, H. (1974). La production de l'espace. *L'homme et la société*, 31-32, 15-32.

Lotz-Coll, S. (2021). Chapitre 6. Les friches urbaines: une opportunité pour un retour de la nature en ville ?, in : J.-P. Carrière, F. Di Pietro, A. Hamdouch, A. Robe, J. Serrano (S.d), *la transformation urbaine au prisme de la nature: questions contemporaines*. Harmattan.

Lynch, K. (1960). *The image of the city*. Cambridge: MIT Press.

Max Raynaud, M. (2014). Design urbain et grands projets : politique publique ou politique privée, in M. Hubert, P. Lewis, M. Max Raynaud, *Les Grands Projets Urbains : Territoires, Acteurs et Stratégies*. Montréal: PUM.

Merlin, P., Choay, F. (2010). *Dictionnaire de l'urbanisme et de l'aménagement*. Paris.

Ministère de l'Aménagement du Territoire, de l'Environnement et du tourisme MATET (2008). *Schéma National d'Aménagement du Territoire SNAT* 2030. Rapport de Synthèse.

Noyer, J., Raoul, B. (2008). Concertation et «figures de l'habitant» dans le discours des projets de renouvellement urbain. *Études de communication. langages, information, médiations*, 31, 111–130. https://doi.org/10.4000/edc.766

Perrocheau, C. (2012). Enjeux, apports et perspectives de la requalification: compte rendu de la soirée-débat. *École Nationale Supérieure d'Architecture de Paris-Belleville*.

Pradel, B. (2013). Rythmes événementiels et aménagement des espaces publics à Paris, Bruxelles et Montréal. *Loisir et Société / Society and Leisure*, 36(1), 78-93. https://doi.org/10.1080/07053436.2013.805581

Saidouni, M. (2001). *Élément d'introduction à l'urbanisme*. Alger: Casbah.

Semple, L. (2017). Le mégaprojet du Dubai Water Canal: fabrique d'une ville mondiale à travers la construction d'un réseau touristique. *Géoconfluences*.

Signoles, P. (éd.) (2014). *Territoires et politiques dans les périphéries des grandes villes du Maghreb*. Paris: Karthala.

Sidi Boumedine, R. (dir) (2013). *Echec des instruments ou instruments de l'échec?*, Alger: Les alternatives urbaines.

Soulier, H. (2004). La friche urbaine des années 80: déchet ou ressource ? Actes du séminaire « Etapes de recherches en paysage », n° 6, *Ecole nationale supérieure du paysage*, Versailles.

Un grand projet de modernisation urbaine d'une capitale régionale (2011). *Wilaya de Constantine*.

Viel, L., Lizarralde, G., Maherzi, F.A., Thomas-Maret, I. (2012). L'influence des parties prenantes dans les grands projets urbains, Cybergeo: *European Journal of Geography* [Online], Regional and Urban Planning, document 604. https://doi.org/10.4000/cybergeo.25310

Wachter, S., Emelianoff, C. (2009). *Dictionnaire de l'aménagement du territoire: état des lieux et prospective*. Berlin: Broché.

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Review article

GLOBALIZATION AND URBAN CENTERS: IMPACT, CHALLENGES AND DEVELOPMENT OF GLOBAL CITIES

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ABSTRACT

The paper focuses on globalization and its impact on the world's urban centers, i.e., on the interaction of globalization and (large) cities. The globalization of cities refers to the process by which the cities become increasingly involved in global economic, political, social and cultural networks. This process means that cities, especially large and important urban centers, become key actors on the international scene, transcending national borders and establishing a direct connection with global markets, cultures, communications and political structures. Special attention is devoted to the development of the so-called global cities, which represent key centers of economic, political and cultural power. The environmental challenges that globalized cities bring are also examined. Finally, the paper considers specific aspects of globalization within the context of Montenegro, analyzing how global processes affect development in that country.

Keywords: *globalization, global cities, urbanization, global economy, ecological challenges*

INTRODUCTION

Although the concept of globalization is relatively recent, certain authors, such as Vukotić, believe that the roots of globalization should be sought in history and prehistory. The roots of globalization are from the moment when homo sapiens started moving out of Africa and inhabiting this planet, and this motto tells us about that: "We are all from Africa!" We are all brothers!" - it is a platform of globalization (Vukotić, 2017, p. 76). It is considered that the first attempts at globalization began after the Second World War, but it gained its greatest importance after the Cold War. The increasingly stronger interdependence of the modern world (the world is a global village) is at work, and the dynamic process of connecting states and cities into one entity is unstoppable. In this sense, the international urban system consists of interconnected cities within national systems, while the global urban system includes global cities that are interconnected. The term "world city" has become more and more familiar with the growth of globalization, including areas such as digitalization, increasing the range of travel, communication, and finance. A world city is a city that has direct or indirect effects on global events through socio-economic aspects.

Global changes have brought a number of advantages, such as undisturbed communication, economic growth and increased competitiveness, development of tourism, science and education, global companies, more intensive struggle for human rights, cultural exchange and access to information, technoprogress. Also,

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rapid global changes have brought a number of disadvantages: the growth of social and economic inequality (expressed so-called culture of misery), foreign interventionism, various cases of abuse, labor exploitation, environmental problems, globalization of culture, disappearance and marginalization of local cultures. No matter how many advantages and benefits they bring, the flows of globalization create new challenges and deepen inequalities. Globalization indicates the need to place the understanding of global cities within the framework of the new reality.

The aim of this work is to enhance our understanding of the complex relationships between globalization and urban development, giving insight into the challenges and opportunities that globalization presents to cities. The work is organized into two parts. The first part discusses globalization in general, covering its causes and consequences. The second part shifts the focus to the globalization of cities, where cities are viewed as world systems that play a key role in global development. Finally, a synthesis presents the conclusions and facts reached from analyzing the phenomenon of the globalization of cities.

DEFINING THE TERM OF GLOBALIZATION

Today, the concept of globalization is known not only in scientific but also in wider social frameworks, so globalization has economic, political, cultural, financial, technological, geographical, sociological, ecological (Grčić, Sluka, 2006), military and geopolitical dimensions. In this sense, cities are places of production and exchange of goods and services, therefore it is required that they are integrated into global networks and flows.

The word globalization is derived from the English word "*globe*", which means Earth, or a spherical celestial body. Globalization encompasses all social processes and relationships that have a planetary character, manifesting in all aspects of world events. Methodologically, the concept of globalization should be viewed through two dimensions – a broader and a narrower meaning. In a broader sense, globalization begins with the earliest forms of human association. If we take into account the basic and well-known fact that humans are social beings, it is easy to trace various forms of association throughout history: from hordes and clans to tribes and peoples and states, to the creation of nations, and later international and supranational forms of association. Global social groups are characterized by the fact that individuals participate in them with their entire personality. It is important to note that long before the formation of nations as historical creations, people were discovering the entire planet and creating connections on a global level (Šuvaković, Kragović, 2015). We live in a world where almost every aspect of our lives is changing, and regardless of whether the changes are positive or negative, we become part of a global order that is not fully understood but whose consequences we all experience1 (quoted in Kovačević, 2013). The narrower meaning of the term globalization refers to specific aspects of globalization, for example, the impact on local culture, international trade, migration, and other areas.

There are many definitions of the term globalization stemming from various scientific fields. Definitions therefore vary depending on what they focus on. It is a historically complex phenomenon, the very meaning of this term is the subject of discussion. An overview of some definitions is given in the appendix.

The world, from many aspects, can be perceived as a unique and interconnected society - this is called globalization (Čejko, 2019). Globalization refers to the increasingly intense connection of economies and societies around the world. Economic dimensions include increasing trade flows of goods and services, capital and ideas, as well as the mobility of individuals (Schwidrowski, Treigiene, 2011). Globalization, in the most basic sense, is described as the process of transforming local phenomena into global phenomena, where people around the world become part of a single society and function together. This process involves a combination of economic, technological, sociocultural and political factors, although the economic aspect is often empha-

[1] Giddens, E., Hutton, W. (2003). Hitting back. In *On the Edge: Living with Global Capitalism* (p. 288). Belgrade: Plateau.

sized in the context of globalization (Stearns, 2010). The globalization of economic activity has increased the volume and complexity of transactions, thereby increasing the demand for top-level multinational headquarters functions and advanced corporate services (Sassen, 2001). Globalization is primarily defined through the mobility and transnational nature of capital, but this political-economic perspective is contrasted with other factors such as migration patterns and demographic development, issues of race and racism, as well as the changing roles of the public sector (Marcuse, Kempen, 2000). Globalization in the broadest sense of the word refers to the expansion of global connections and includes several large processes. It can refer to real processes, ideas that justify them and ways of thinking about them. The term is not neutral, as definitions reflect different assessments of global changes (Internet 1). Globalization has an impact on almost every aspect of life, which attracts the attention of many scientific disciplines.2 It represents one of the key concepts in social sciences from the 1980s until today (Pajvančić-Cizelj, 2015). This leads to an excessive growth of interest in this topic and great confusion in the understanding of what globalization actually represents. In addition, it is difficult to reach clear conclusions because globalization significantly affects science itself and its findings (Bauman, 1998).

Conceptual frameworks of globalization

While for some globalization means the integration of the world and the creation of a global economy and culture, for others it means the division and clash of civilizations (Petrović, 2004). Globalization has become a matter of "the greatest urgency" in the first decade of the 21st century. According to one opinion, it is a new term that can be traced back to the 1980s. On the other hand, there is an opinion that globalization has a long history that reaches back to the 19th century and even earlier (Hopkins, 2002). The idea of globalization in the modern age originates from Immanuel Kant, while globalization as a real process began in the second half of the 20th century. It develops in the most developed countries and from there spreads to the rest of the world, both in a straight line and in a concentric pattern (Čupić, 2015). In the second half of the 20th century, a new economic wave, the so-called globalization appeared. Globalization represents connections that go beyond the boundaries of the nation-state, and their goal is to increase economic growth and wealth (Waters, 2001). More radical shifts in the literature that question economic conceptions of globalization are derived from the "adding" of sociocultural or sociopolitical dimensions and instead advocate the need to present globalization as a discursive formation (Yeoh, 1999). Sociologist Nederveen (2006) suggested that Eurocentric globalization is geographically centered on the West and preoccupied with recent post-war history, but he also elaborates on the concept of Eastern or Oriental globalization, which he mainly associates with India and China.

In a methodological and theoretical sense, globalization represents a concept or paradigm with the help of which various sciences seek to understand the functioning of humanity in the 21st century (Waters, 2001). Globalization is practically everywhere around us, in our country and cities. It is one of the most powerful and trenchant images of the world today. Globalization has captured the imagination of a series of individuals, from policymakers to politicians, to individual investors who are tapping into the global network at all levels (Short et al., 2000).

Globalization overcomes all differences and historically created borders, because "globalization knows nothing local, and only one who knows something and has the courage to market that knowledge on the international market is global" (Vukotić, 2020). Globalization undoubtedly leads to the erosion of state sovereignty. All this can perhaps be best understood if we look at our Blue Planet from the Cosmos. Seen from that point of view, national differences, state and other borders are not recognized.

[2] Globalization has become one of the organizing principles in the social sciences (Short et al., 2000).

Causes and consequences of globalization

When it comes to the causes of globalization, one should bear in mind that it is a complex process and that at every moment it is not possible to enumerate all the causes that can be attributed to that term. The development of technology, the Internet and informatics in general3, plays a significant role in the process of globalization, and the Internet itself is sometimes synonymous with globalization. Modern technology has contributed to reducing the need for physical movement of people and speeding up the movement of information. Modern information technology has led to the reduction of transport costs, fast payment systems and the development of digital culture worldwide. Now, in a few seconds, we can send an entire database to all corners of the world, educate ourselves online and do business online - an *online* entrepreneur (Blum, 2013). Globalization was made possible by innovations in transportation technology (highways, vehicles, railways and air traffic), as well as in the sphere of information and communication technologies (the Internet, digital, social and mobile media). There are more and more commercial and social transactions involving multiple countries. The Internet is not the only network that enables communication, there are also instant SMSs enabled by mobile and satellite networks, not the Internet, but they are digitized and serve to connect people. Even books can be produced and distributed more easily and cheaply than before. *The online*, digital world is actually not independent from *the offline*, physical world but is an integral part of it. The digital world is very real (Čejko, 2019).

The bottom line is that technology and information sharing are changing the world - people, cities and countries are becoming super-connected. No obstacles, bureaucratic or others, stand in the way of anyone who wants to communicate, be included in the global network of goods, information and people, improve their economic situation, and costs have been reduced to a minimum. A computer is part of the furniture in every family, and the state of the world's stock markets can be monitored 24 hours a day. Everyday education and teaching also create a network of contacts (the best examples of this are student exchanges that are current in Montenegro and the whole world, as well as *the Work and Travel* program). Therefore, students, as a young population, are significantly involved in globalization processes. There are more than 8 billion people4 and about 350 million students in the world, therefore, "That competition brought by globalization is a new torment, a new challenge, a new threat, a new necessity for all of us" (Vukotić, 2024, p. 6).

The following picture shows only some of the causes of globalization:

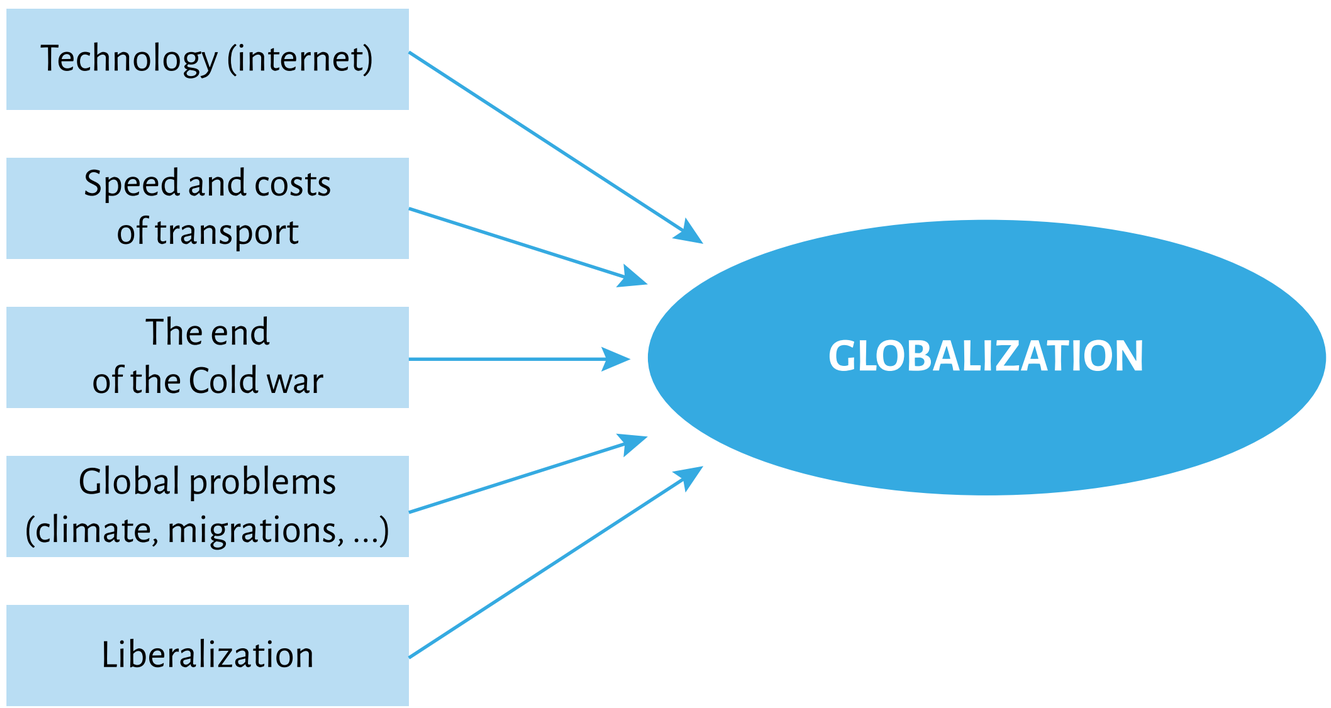

Figure 1. Causes of globalization
Source: Bogdanović, Vuković, 2015, p. 34

[3] The information age (digital age) or information era is a period in which digital technology has become dominant in all aspects of life. It began in the middle of the 20th century, with the development of computers and digital communications, and continues to this day. In this age, information is processed and transmitted quickly. The information age is characterized by technological progress and global networking.

[4] At the end of 2022, the number of inhabitants on Earth exceeded 8 billion.

Political changes stemming from the end of the Cold War and the fall of the Berlin Wall led to the "unification" of East and West, which accelerated global connectivity. The United States assumed a leading role on the world stage, becoming the first and only global world power (Brzezinski, 1997), while Southeastern European countries such as Czechoslovakia and Yugoslavia disintegrated, and numerous small states appeared in their place. The countries of East and Southeast Asia had a strong economic impulse and rise. Numerous international organizations focused on global issues, such as environmental protection (e.g. *Greenpeace, World Wide Fund for Nature*), human rights, and migrations, including the transition from rural to urban areas and from less developed to developed countries have emerged. There has been a liberalization of world trade, a change in consumer mentality, and shifts in lifestyle, leading to the disintegration and change of traditional value systems. The consequences of globalization are mainly determined by economic forces. Supporters of globalization believe that the aim of globalization is to bring countries in the world closer together and integrate, while opponents believe that globalization serves as a tool of the West to impose hegemony on less developed countries and maintain primacy in the world of neo-colonialism.5 The following picture presents some of the many consequences of globalization, more precisely the accelerated development of cities, the process of industrialization and the general creation of an environment for life to take place at an accelerated pace.

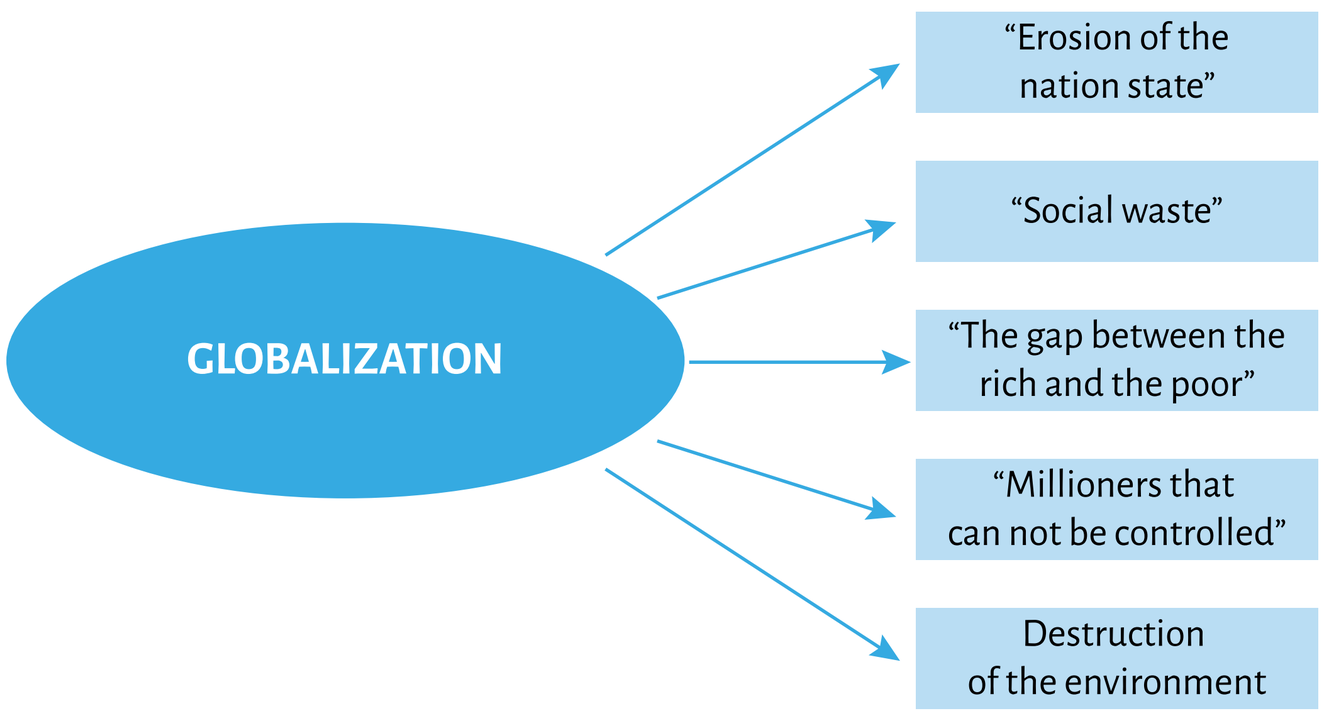

Figure 2. Consequences of globalization

Source: Bogdanović, Vuković, 2015, p. 35

As can be seen from Figure 2, globalization has also caused problems such as cultural homogenization, environmental challenges - increased pollution, digital inequality, the creation of a huge gap between the rich and the poor, political friction, and divided the layers of society. "Besides dilemmas and debates about the global and the local, another contradiction in the globalization process is the increase in the wealth of the rich and new types of poverty" (Seferagić, 2007, p. 363). Some consequences can be influenced, while others, unfortunately, cannot.

[5] Hegemony is as old as humanity, but today's global supremacy of the USA differs in the speed of its emergence, in its globality and in the manner in which it is implemented (Brzezinski, 1997).

GLOBALIZATION OF CITIES

The city is an extremely complex social phenomenon and as such represents the most obvious expression of human material activity in geospace. It is usually defined as a connected, densely populated area in which a large number of inhabitants live, with functions developed based on the demarcation of secondary and tertiary activities (Bakić et al., 2009). Large cities and densely populated metropolitan regions have long tended to develop in accordance with the trends of globalization, so they take on special names such as megalopolises and urban galaxies.

Cities are the scenes of globalization, even when they are not aware of their role, or when they are "against" that role. In the process of economic, cultural and social globalization, the world has become integrated and coherent. Once isolated, local markets have become connected. Global institutions and organizations now direct and encourage production and consumption. Social patterns and relationships, once limited to the local level, have become global. Cities can be considered the "pearls" of civilization. All great civilizations developed according to a model that was focused on cities. The contemporary global civilization, which is currently taking shape, also adopts an urban-oriented structure (Grčić, Sluka, 2006).

While globalization primarily takes place in cities, the past decades have been marked by the growth of cities in size and structure and their expansion into new territories. The transformation of global society took place, which became predominantly urban, developing new ways of life. The phenomenon of the global city first appears in megalopolises, multi-million cities. In many countries, there are cities with millions of residents where a large part of the urban population is concentrated. In most cases, the most significant cities are capitals or primate cities, though they do not necessarily have the function of the capital (Grčić, Sluka, 2013). Megacities (megalopolises) are, by the UN definition, cities with over 10 million inhabitants. In 1975, out of a total of five megacities, two were located in South America, two in Asia and one in North America (Grčić, Sluka, 2006). In 1985, six megacities were located in five countries: Indonesia, Brazil, Mexico, Japan, and the United States. This distribution was equalized between developing and developed countries. Between 1980 and 2020, the number of countries with megacities increased from five to twenty- one. It can be seen that megacities are mostly concentrated in the less developed part of the world, with 17 of the 21 megacities located there, compared to only four megacities in the "developed world" (Ding et al, 2022). It is clear that this is a continuous increase in the number of megalopolises, in which an increasing percentage of the urban population will reside.

Cities in the function of world systems

The signs of the creation of a "global society" are three principal elements: economic integration, the creation of a global cultural community and political identity (Grčić, 2000). By the middle of the 21st century, geographer Grčić predicts that there will be a global government and global geopolitical structures on the world stage.

The issue of spatial identity is of key importance for the experience (feeling) of a place in the emerging global world. With the development of the globalization process, spatial identity has become an important factor in the planning process. Globalization, on the one hand, causes changes in the economy of cities and regions that can be so drastic that they lead to the loss of their identity. On the other hand, it forces cities and regions to adapt to new markets and political integrations. This is how cities and regions face a double challenge: the loss of the old and the acquisition of a new identity (Šaban, 2006).

The Industrial Revolution caused extensive urbanization and the development of modern cities. Cities such as Manchester, London, Paris and New York became key industrial centers that drew labor from rural areas. Today, global capital and new labor from immigration are two key examples of transnational actors that operate across borders and have unifying features. However, they often come into conflict within global cities (Sassen, 2005).

Until the 1980s, the ecological-evolutionary approach to the study of the cities in modern industrial society in the world frameworks assumed the modernization thesis of a close correlation between industrial and urban development. Based on this, the regularity was derived that all cities of the world at the same level of industrialization, regardless of the type of socio-economic and political organization or cultural development, exhibit more or less the same spatial model, which is based on the universalization of the experience of cities in the West. The concept of network connection, made possible by new information technology, received its spatial expression in the concept of a network of world cities, which suggests an increasing degree of interdependence of cities in various parts of the world, according to the principle of horizontal (spatial) networking. It is clear that the tendency is to move away from geographically compact networks toward the agglomeration of urban zones6, dispersion and networking. Hočevar (2005, p. 713) believes that "contemporary cities should be viewed first of all as fragmented local ties of global networks of individual and collective actors that are connected with different flexible spatio-temporal practices and different life and business styles, instrumentally or reflexively, with one city". Cities serve as nexus (connections), they are connected and shaped by political-governmental (state), market-economic (market), civil-social (social) and geographic-natural (geo-spatial) activities that occur at all spatial levels (Jacobs, 2016).

The growing importance of cities as the center of global economic flows imposes the question of whether it is possible for the cities of less developed countries to find themselves at a significantly higher position in the world hierarchy of cities (vertical feature) in relation to the countries on whose territory they are located. The theorists of dependent urbanization believe that this is not possible because economic polarization and dependent development occur in time-space compression, which conditions that the large cities of the periphery share the fate of an agrarian society that encourages their demographic growth and that they also essentially belong to a slow economic time zone (Knox, Taylor, 1995). In the context of globalization, it is often pointed out that the national state has become too small to solve global problems, and at the same time too large to deal with the everyday needs of the local population. This raises the question of whether cities have become key actors in the regulation of social processes or whether they are global forces. The neoliberal approach supports the latter option, suggesting that important decisions regarding local labor and capital markets are made outside national centers of power, according to the interests of transnational companies, rather than according to the needs of local populations.

Development of global cities

Friedman and Wolf (1982) listed some of the characteristics of established global cities, which include their dominance in the hierarchy, rapid expansion, typically having 5-15 million inhabitants and being highly urbanized. Debates about the global city have taken on a recognizable, and maybe formal, character, set within a conceptual and epistemological framework (Smith, 1998). For a certain city to be classified as a "global city", it is necessary that its functional elements and role, i.e. its position in the global network of cities must be changed in relation to cities that are not considered global. According to Hall (1998), some of the main functions that characterize global cities, include fulfilling the hierarchical structure of cities by dominating and serving as centers of world trade, hosting the headquarters of transnational companies, being centers of political power, serving as hubs for financial companies and services, facilitating technological development, and providing legal, medical and educational activities and services. Finance and information technology (IT) have become key forces in economic globalization. Global cities now combine the functions of IT and financial centers as core features.7 These cities can be categorized into four tiers, with New York, Beijing, London and San Jose ranking at the highest level. In China, cities like Beijing and Shenzhen rank high on the list

[6] The universal contemporary tendency of urbanization (from the second half of the 20th century onwards) through the integration of the national territory, with the action of centripetal forces.

[7] The term "information city" (Castells, 1989) refers to cities that are central to the global economy and where information and communications are key to economic growth and social dynamism.

of emerging global cities. For example, Beijing is listed among the leading global first-tier cities, while Shenzhen and Hangzhou belong to the significant second-tier global cities (NI, 2021). These and other major world cities are key participants in the globalization process because they provide the infrastructure and expertise that enable corporations to control their distant activities (Hill, Fujita, 2003).

Global cities are not only unique in their role in the global network but also in their specific ways of life. Most of the population is employed in the service sector, while the manufacturing industry is in decline. Although the term "global city" is new, the idea of placing cities in a broader, i.e. the global context, is not. With the development of globalization, economic activities and mass consumption have increased, contributing to the creation of global cities. The global functions as a part of a network and in this sense there is a sharp contrast with the former capitals of empires. Networks of major international business centers create new geographies of centrality (Seferagić, 2007). Urban and general sociological theories have often developed through the generalization of the specifics of Western experience, which then become the standard. Global cities in developing countries are converging around a model of development similar to that of the prototypical global cities in the United States, Europe, and Japan. In this sense, the function of certain (Western) cities as command points in the world economy is important. Representatives of the public and private sectors strive to build the tallest buildings, the most modern railway systems or the most impressive airports, in order to highlight their global connections. In many countries outside the West, wealthy elites seek apartments that are clearly modeled after what is perceived as European and American style (Shatkin, 2007).

However, there is a wealth of sources and information, which allows easier access to data about urban societies outside the West, which are no longer static, the East is "waking up" and developing in every aspect, including urbanization and globalization. An example of a global city in a highly developed country is certainly New York or Tokyo, both of which are financial centers with global influence and economy and at the same time have a high standard of living. On the other hand, cities in developing countries and countries of the "Global South" often face challenges such as rapid urbanization and a lack of basic infrastructure. São Paulo, the largest city in the southern hemisphere, is characterized by significant socio-economic inequalities and poor neighborhoods. Similar phenomena are present in Lagos, Nigeria and Mumbai, India.

The term "Global South" includes the regions of Latin America, Asia, Africa and Oceania. This term, along with the terms "Third World" and "Periphery", refers to areas outside of Europe and North America that are mostly low-income and often politically and culturally marginalized (Dados, Connell, 2012). It is clear that a large number of mega-cities are located in poorer countries with larger populations, but for many smaller cities in general, even the mega-city category is irrelevant (Robinson, 2008). On a global level, the question arises whether the ultimate outcome of hyper-connectivity will be the merging of all urban areas and megalopolises into a single ecumenopolis (city-planet).

Globalized cities as an ecological threat

A major problem and threat to the world's ecology originates from both developed and industrially underdeveloped countries, which generally lack developed ecological awareness, and mostly rely on outdated, "non-ecological" technology, thus causing damage to current and future generations. Many cities are taking measures to reduce their environmental footprint, including improving public transportation, recycling, using renewable energy sources, and developing and expanding green spaces. For example, Copenhagen aims to become a carbon-neutral city by 2025 through the implementation of a comprehensive set of sustainable and "green" practices. Vienna, Stockholm and Amsterdam have similar initiatives.

Cities are one of the main causes of environmental disturbances and significant pollution around the world. Planet Earth is becoming increasingly urbanized; back in the 1980s, three-quarters of the countries in Europe and North America had over 75% of their population living in urban areas (Grčić, Sluka, 2006), and the number of such cities is constantly increasing. Urban areas and populations are constantly growing. While developed countries are already highly urbanized, countries in transition and underdeveloped coun-

tries are experiencing rapid migration to larger cities. Natural resources are continuously depleted and diverted to urban areas in order to meet the growing needs of consumers. Various goods and energy are exchanged between cities and their surroundings. Cities consume energy for transport, cooling, and heating, while waste from cities is disposed of in their surroundings (Furundžić, 2009). Cities have become epicenters of ecological disturbances, which spread from them all over the world. Cities are suitable for studying environmental changes, and everything is connected in the biosphere. Ecosystems spread continuously, over uninhabited and urban areas, i.e. cities are ecosystems. Urban ecosystems are particularly changeable, exposed to environmental influences and natural disasters such as fires, floods, earthquakes, etc. (Marzluff, 2008). Economic growth and environmental protection are difficult to harmonize on a global level so that both the economy and the ecology progress at the same time.

Sustainable urban development includes ecological, economic, social and cultural aspects of urban development as well as complex goals. In the planning of sustainable development, a wide range of leading concepts has been recorded, starting from the initiative of "urban reforestation" (Bakić et al., 2009), to the "garden city" and the strategy of "urban greening". The adaptation of various industries to strict environmental regulations, on the other hand, provides environmental protection, but also slows down economic growth and reduces competitiveness in the market. The balance between economic development driven by globalization and a healthy environment can only be achieved through sustainable development.

Globalization and Montenegro

In Montenegro, the network and system of settlements consist of a center of national importance (Podgorica), a national center of special importance (the capital Cetinje), centers of regional importance (Bar, Budva, Bijelo Polje, Berane), a center of municipal importance (Plužine, Šavnik, Žabljak, Danilovgrad, Kolašin, Rožaje), more important local centers (Gradac in Pljevlja, Petrovac in Budva), local centers (Ostros in the municipality of Bar; Dragalj and Crkvice in the municipality of Kotor; Radovići in the municipality of Tivat...) (Doderović, Ivanović, 2019). Like all the cities of the world, Montenegrin cities have «succumbed» to globalization.

Countries that have undergone transition, or are still in the process, especially small ones like Montenegro, should maximize the positive ranges of globalization, which opens up opportunities for them, primarily modernization in the broadest sense and broadens horizons - beyond the local perspective. Obviously, there is no dilemma for such an approach for small countries, but the issue lies in how to take advantage of these opportunities and avoid risks or minimize them. It is the small countries that should accept the modernization and achievements of modern science in every sense, especially the achievements of the technical process in some scientific areas of sustainable technologies and information and communication technologies.

Montenegro is a country with a specific, attractive, and strategically significant geographical position, regional diversity, and characteristics of demographic aging, migration and emigration. Although small by these parameters, Montenegro possesses significant resources and development potential. Despite numerous economic and other challenges, the country has diversified structures in economy, education, science, culture, and resources across its northern, central and southern regions (Kostić, 2017). As a potential member of the European Union, Montenegro faces numerous challenges, including those that adapt Montenegrin society to modern and prospective societies. The globalization shift is visible, globalization certainly offers opportunities. Thus, the question arises: how much is Montenegro capable of opening up to the world and what can it offer to the world? This is the question of our future. Our duty is to be cosmopolitan and responsible citizens of the world in that future, as a future global city (city-planet).

CONCLUSION

The concept of the global city has evolved over the centuries, moving from early trade centers to modern urban hubs that shape the global system. Among other things, globalization dictated the model of urban development. Today, global cities play a key role in the modern world, influencing economic, political, cultural and ecological flows.

Globalization is a process that largely depends on the progress of science and education, while simultaneously influencing them. A key role in this process is played by new information technologies, which have become essential for modern learning and business. Therefore, the paper points to the most important changes in the sphere of economy and politics, as well as the power of individual multinational companies and countries at the global level. Globalization and networking are needed by individuals and humanity itself because they enable better connection, and exchange of ideas and resources, as well as mutual understanding and cooperation around the world.

From all of the above, it can be concluded that globalization is a complex and contradictory developmental process. Under current conditions, it can be concluded that the positive dimensions of globalization come to the fore less and the negative dimensions more. Globalization has become a term of criticism because it is the source of unwanted changes. This is especially manifested in terms of deepening the gap between developed and underdeveloped countries, the rich and the less rich. Also, it is concluded that the effects of globalization are historically and geographically uneven, but it can also be confirmed by the fact that globalization is a social and geographical phenomenon because it involves the integration of distant places, people, and goods.

Globalization certainly represents an unfinished historical process that takes place in waves, in which cities have always played a key role. The current phase of globalization should be understood as the latest wave, not as its beginning. Globalization began in the 1970s, marked by an economic crisis, an increase in direct foreign investments, the expansion of financial markets, greater labor mobility, and the spread of neoliberal ideology in all spheres of social life. It is an era in which globalization and technology are changing our perception of the world. From New York, London, Shanghai and Moscow to the global stage, in the future, we will be able to experience the world like never before, and this is what the globalization of cities provides.

REFERENCES

Bakić, R., Doderović, M., Mijanović, D. (2009). *Settlements in the area.* Nikšić: Institute of Geography, Faculty of Philosophy.

Bauman, Zygmunt (1998). *Globalization: The Human Consequences.* Columbia: Columbia University Press.

Bloom, A. (2013). *Tubes: A journey to the center of the Internet.* New York: Ecco.

Bogdanović, D., Vuković, M. (2015). Globalization - two sides of modern society. *Engineering Management,* 1(1), 30-41.

Brzezinski, Z. (1997). *The grand chessboard: American primacy and its geostrategic imperatives.* New York: Basic Books.

Castells, M. (1989). *The informational city: Information technology, economic restructuring, and the urban-regional process.* Oxford, UK, and Cambridge, MA: Basil Blackwell.

Čejko, M. (2019). *Superconnected: The Internet, Digital Media, and Techno-Social Life.* Belgrade: Clio (in Serbian).

Čupić, C. (2015). Globalization and democratic political culture. In: Vukotić, V., Šuković, D., Rašević, M., Maksimović, S., Goati, V. (eds.): *Globalization and Culture.* (pp. 44-50). Belgrade: Institute of Social Sciences, Center for Economic Research (in Serbian).

Dados, N., Connell, R. (2012). The global South. *Contexts, 11* (1), 12–13. https://doi.org/10.1177/1536504212436479

Ding, C., He, X., Zhu, Y. (2022). Megacity growth, city system and urban strategy. *Chinese Journal of Urban and Environmental Studies*, 10 (1), 1-19. https://doi.org/10.1142/S2345748122500051
Doderović, M., Ivanović, Z. (2019). Transformation of the network of settlements, towns and villages in Montenegro. *Matica*, 80, 49-92.
Friedmann, J., Wolff, G. (1982). World city formation: An agenda for research and action. *International Journal of Urban and Regional Research*, 6 (3), 309–344. https://doi.org/10.1111/j.1468-2427.1982.tb00384.x
Furundžić, D. (2009). Globalization and urban ecology. *Ecologica*, 16(55), 457-461.
Giddens, E., Hutton, W. (2003). Hitting back. In *On the Edge: Living with Global Capitalism*. Belgrade: Plateau.
Grčić, M. (2000). *Politička geografija*. Beograd: Geografski fakultet.
Grčić, M., Sluka, N. (2013). Urbocentric model of global civilization. *Proceedings - Faculty of Geography, University of Belgrade*, 61, 1-30.
Grčić, M., Sluka, N. (2006). Globalni gradovi. Beograd: Geografski fakultet, Moskva: MSU "MV Lomonosov".
Hall, P. (1998). Globalization and the world cities. In Fu-chen Lo & Yue-man Yeung (Eds.), *Globalization and the world of large cities* (pp. 17-36). Tokyo: United Nations University Press.
Hill, RC, Fujita, K. (2003). The nested city: Introduction. *Urban Studies*, 40 (2), 207–217. https://doi.org/10.1080/0042098032000080251
Hočevar, M. (2005). The concept of networking cities - globalization. *Sociology and space*, 43(3), 691-724.
Hopkins, A. G. (2002). *Globalization in World History*. New York: WW Norton & Company.
Jacobs, A. J. (2016). The city as the nexus: Bridging the state, market, societal, and geospatial contexts. *Cities*, 51, 84–95. https://doi.org/10.1016/j.cities.2015.11.018
Knox, P. L., Taylor, P. J. (1995). *World Cities in a World-System*. Cambridge: Cambridge University Press.
Kostić, M. (2017). *Globalization, a small country and challenges for science with special reference to Montenegro*. Podgorica: CANU.
Kovačević, I. (2013). *Globalization, geopolitics and ecology*. Banja Luka: European Defense Center.
Marcuse, P., Van Kempen, R. (2000). *Globalizing cities: A new spatial order?* London: Blackwell.
Marzluff, JM (2008). *Urban ecology: An international perspective on the interaction between humans and nature*. New York: Springer.
Nederveen Pieterse, J. (2006). Oriental globalization: Past and Present. In G. Delanty (Ed.), *Europe and Asia beyond East and West: Towards a new cosmopolitanism*, 23 (2-3), 61-73. https://doi.org/10.1177/0263276406023002741
Ni, P., Shen, L. (2021). The new global city hypothesis: Theoretical connotation and characteristics. *Chinese Journal of Urban and Environmental Studies*, 9 (3), 1-18. https://doi.org/10.1142/S2345748121500159
Pajvančić-Cizelj, A. (2015). *The concept of the global city as an approach to understanding contemporary patterns of urbanization and globalization*. Doctoral dissertation. Novi Sad: Faculty of Philosophy, Department of Sociology (in Serbian).
Petrović, M. (2004). Globalization and cities. *Sociology*, 46(1), 19-44. https://doi.org/10.2298/SOC0401019P
Robinson, J. (2008). Global and world cities: A view from off the map. *International Journal of Urban and Regional Research*, 26 (3), 531-554. https://doi.org/10.1111/1468-2427.00397
Sassen, S. (2001). *The global city: New York, London, Tokyo* (2nd ed.). Princeton and Oxford: Princeton University Press.
Sassen, S. (2005). The global city: Introducing a concept. *Brown Journal of World Affairs*, 11 (2), 27-43.
Schwidrowski, Z. B., Treigiene, D. (2011). *Globalization and growth in recent research*. New York: United Nations Organization.
Seferagić, D. (2007). Actors of social changes in the urban area of Croatia. *Sociology and space*, 45(3/4), 361-376.
Shatkin, G. (2007). Global cities of the South: Emerging perspectives on growth and inequality. *Cities*, 24(1), 1-15. https://doi.org/10.1016/j.cities.2006.10.002
Short, J. R., Breitbach, C., Buckman, S., Essex, J. (2000). From world cities to gateway cities: Extending the boundaries of globalization theory. *City*, 4(3), 317–340. https://doi.org/10.1080/713657031
Smith, M. P. (1998). The global city - whose city is it anyway? *Urban Affairs Review*, 33 (4), 482-488. https://doi.org/10.1177/1078087498033004003

Stearns, P. N. (Ed.). (2010). *Globalization in World History.* New York, London: Routledge.
Šaban, S. (2006). The influence of the globalization process on spatial planning. *Space*, 14(2), 238-244.
Šuvaković, U., Kragović, B. (2015). Globalization and cultural identities. In: Vukotić, V., Šuković, D., Rašević, M., Maksimović, S., Goati, V. (rds.): *Globalization and Culture*. (pp. 297-303). Belgrade: Institute of Social Sciences, Center for Economic Research (in Serbian).
Vukotić, V. (2017). Globalization and isolationism - ideology or history of the future. In *Globalism vs. Nationalism International conference*, pp. 73-86. Podgorica: CANU.
Vukotić, V. (2020). Statement given at the Miločer Development Forum, Podgorica, available at: https://www.vijesti.me/vijesti/ekonomija/480215/vukotic-globalizacija-ne-poznaje-nista-lokalno (Last accessed April 4, 2024)
Vukotić, V. (2024). *From the work of Tomov to Njegoš (Ideas and character project).* Podgorica: UDG (in Serbian).
Waters, M. (2001). *Globalization* (2nd ed.). London: Taylor & Francis e-Library.
Yeoh, B. A. (1999). Global/globalizing cities. *Progress in Human Geography*, 23(4), 607-616. https://doi.org/10.1191/030913299674647857

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Internet 1. https://edukacija.rs/poslovne-vestine/menadzment/globalizacija-i-menadzment-u-globalnom-okruzenju (Last accessed April 4, 2024)

CONFLICTS OF INTEREST

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